1934.

QUEENSLAND.

THIRTY-FOURTH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS.

REPORT OF THE DIRECTOR

TO

THE HON. THE SECRETARY FOR AGRICULTURE AND STOCK

(*As required by "The Sugar Experiment Stations Act of* 1900").

PRESENTED TO PARLIAMENT BY COMMAND.

BRISBANE:
BY AUTHORITY: DAVID WHYTE, GOVERNMENT PRINTER.

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A. 48—1934.

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THIRTY-FOURTH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS.

Director's Report.

TO THE HONOURABLE THE SECRETARY FOR AGRICULTURE AND STOCK.

SIR,—I have the honour to submit the Thirty-fourth Annual Report of the Bureau of Sugar Experiment Stations for the year ended 31st October, 1934.

H. W. Kerr.

Brisbane, 14th December, 1934. Director.

General.

The growing season for the 1934 crop may be described briefly as one of abnormally high rainfall, combined with sub-normal temperatures and a deficiency of sunshine in all areas. The net effect of these conditions was variable. In the Northern areas, excessive rains resulted in heavy flooding, and damage to the crops which were in most instances backward when the wet season broke. Continued rains during the autumn and winter of 1933 made it almost impossible to plant during that period, and an undue proportion of the land was not planted until the spring. These crops were handicapped throughout the growing period. Due to the prolonged crushing season, many ratoon blocks had not germinated before they were flooded, and they never recovered. The heavy rains were accompanied by a cyclonic blow at Mossman, which severely damaged the crops. Excessive wet conditions favoured the incidence of pests, and a large percentage of the crop was damaged by rats, grubs, and borers. Finally, an early and extensive arrowing precluded the possibility of winter growth, and the tonnages crushed by the Northern mills showed a very high reduction over those of the previous record year.

In the dry Burdekin area, the abnormal rainfall was responsible for highly favourable growing conditions, so that all mills in that district are harvesting record tonnages. Despite increased crushing rates, one of the mills anticipates a crushing season extending into February.

The Mackay area generally benefited from the conditions experienced. The spring of 1933 was abnormally wet, but fields which had been planted early were able to make steady progress throughout, so that these crops were highly advanced by the end of the year. The 1934 rainfall was also well distributed, and many heavy crops have been harvested. Ratoons in general, and late ratoons in particular, suffered from lack of cultivation which was unavoidable in the circumstances. In the aggregate, satisfactory results have been obtained, and the crop is but little inferior to that of 1933. With the advanced nature of the cane, combined with a dry harvesting season, the sugar content of the cane was also highly satisfactory.

General—continued.

The Southern districts also enjoyed the benefits of abnormally high rainfalls, and most mills have been faced with the harvesting of record crops. In many instances a proportion of the cane will be allowed to stand over until 1935, to avoid the production of an undue proportion of excess sugar. The following are the individual mill estimates submitted in October, 1934; the actual figures of the 1933 crop have been added, for comparative purposes :—

Crop Estimates for 1934, and Actual Yield for 1933.

Mill.	Estimate, October, 1934.	Actual Yield, 1933.	Increase (+) or Decrease (−) for 1934.
	Tons.	Tons.	Tons.
Mossman	84,300	137,064	− 52,764
Hambledon	186,000	216,479	− 30,479
Mulgrave	180,000	239,526	− 59,526
Babinda	132,752	260,636	−127,884
Goondi	140,000	192,084	− 52,084
South Johnstone	203,000	286,385	− 83,385
Mourilyan	158,000	187,527	− 29,527
Tully	229,353	302,736	− 73,383
Victoria	230,000	247,261	− 17,261
Macknade	185,000	200,732	− 15,732
Invicta	125,625	78,617	+ 47,008
Pioneer	233,000	166,902	+ 66,098
Kalamia	244,000	204,302	+ 39,698
Inkerman	283,000	219,988	+ 63,012
Proserpine	148,000	172,066	− 24,066
Cattle Creek	72,000	63,005	+ 8,995
Racecourse	150,000	153,689	− 3,689
Farleigh	172,000	144,263	+ 27,737
North Eton	69,500	68,364	+ 1,136
Marian	122,000	137,862	− 15,862
Pleystowe	154,000	155,422	− 1,422
Plane Creek	160,000	172,725	− 12,725
Qunaba	70,000	51,636	+ 18,364
Millaquin	138,000	103,914	+ 34,086
Bingera	150,000	118,070	+ 31,930
Fairymead	120,700	117,356	+ 3,344
Gin Gin	45,000	16,166	+ 28,834
Isis	172,000	94,977	+ 77,023
Maryborough	24,800	29,088	− 4,288
Mount Bauple	32,500	27,267	+ 5,233
Moreton	48,000	82,362	− 34,362
Rocky Point	7,200	15,979	− 8,779
Eagleby	1,320	2,578	− 1,258
Total	4,471,050	4,667,028	−195,978

The average sugar content of the crop will be an improvement on the results of 1933; assuming that 1 ton of 94 n.t. sugar will be made from 7·1 tons of cane, the sugar yield for Queensland will be approximately 630,000 tons.

General—continued.

In addition, it is estimated that the New South Wales crop will amount to 30,000 tons of sugar, giving a total Australian production of sugar from cane of 660,000 tons. This figure is identical with that realised for the 1933 crop.

FIGURES OF THE 1933 CROP.

The yield of raw sugar in Queensland for 1933 was 638,734 tons of 94 n.t. This was far in excess of the 1932 crop of 514,027 tons, and constitutes an all-time record. The yield increase was due to unusually heavy crops in almost every mill area from Mackay north, while normal crops were harvested in the Southern districts.

The total area harvested in 1933 was 228,154 acres. The yield of cane per acre crushed was 20·46 tons; this is the highest recorded since 1917.

The following were the yields of cane and sugar per acre in the respective sugar districts :—

Acreage Yields by Districts.

District.	Tons Cane per acre.	Tons 94 N.T. Sugar per acre.
Mossman to Ingham	23·67	3·24
Lower Burdekin District	29·06	4·41
Proserpine	17·04	2·38
Mackay to St. Lawrence	16·47	2·28
Bundaberg, Gin Gin, &c.	15·43	1·84
Maryborough, Childers, &c., to Gympie	12·13	1·27
Nambour and Beenleigh	19·67	2·55
State Average	20·46	2·80

In his 1933 Report, the Registrar-General shows the average acreage grown by cane-planters in Queensland to be as follows :—

Cairns to Townsville	54 acres
Ayr to Mackay	47 ,,
Bundaberg to Bauple	32 ,,
Nambour to Beenleigh	12 ,,
Average	42 ,,

The average per planter is 42 acres, which is 2 acres higher than that of the previous year, and equal to that of 1932.

The tons of cane required to make a ton of 94 net titre sugar was 7·31. This value is the highest recorded in Queensland since 1927, and is to be attributed to the large proportion of immature cane harvested.

The following table gives the crop statistics for Queensland for the past ten years :—

Table showing Acres Cultivated and Harvested, Yields of Cane and Sugar, Acre-Yields, and Quality of Cane, 1924–1933.

Year.	Acres Cultivated.	Acres Harvested.	Total Yields.		Yields per Acre.		Tons Cane to 1 Ton Sugar.
			Cane.	Sugar.	Cane.	Sugar.	
			Tons.	Tons.	Tons.	Tons.	
1924	253,519	167,649	3,171,341	409,136	18·92	2·44	7·75
1925	269,509	189,466	3,668,252	485,585	19·36	2·56	7·55
1926	266,519	189,312	2,952,662	389,272	15·45	2·06	7·52
1927	274,838	203,748	3,555,827	485,745	17·45	2·38	7·32
1928	283,476	215,674	3,736,311	520,620	17·32	2·41	7·18
1929	291,660	214,880	3,581,265	518,516	16·67	2·41	6·91
1930	296,070	222,044	3,528,660	516,783	15·89	2·33	6·83
1931	309,818	233,304	4,034,300	581,276	17·29	2·49	6·94
1932	291,136	205,046	3,546,443	514,085	17·30	2·51	6·90
1933	311,910	228,154	4,667,028	638,734	20·46	2·80	7·31
10 Years' Average					17·61	2·44	7·22

In 1933, the ten mills north of Townsville produced 311,825 tons of sugar, while the twenty-three south of Townsville produced 326,909 tons.

General—continued.

MOLASSES PRODUCED.

The following figures supplied by the Registrar-General show the manner in which the molasses produced in 1933 was disposed of :—

	Gallons.
Sold to distilleries	4,107,566
Burnt as fuel	7,348,015
Used or sold for feed	2,902,188
Sold for other purposes	340,928
In stock	634,022
Used as manure	1,793,101
Run to waste	1,747,365
Total	18,873,185

It is interesting to note that the proportion of the molasses yield purchased by the distilleries showed a gain of 1,300,000 gallons over that of 1932, while a substantial increase (380,000 gallons) in the proportion employed as manure was also recorded.

MAFFRA BEET FACTORY.

During the past season the Maffra Sugar Factory, Victoria, manufactured 5,303 tons of sugar from 50,625 tons of beets. The average yield of beets per acre was 15·7 tons.

SUGAR VALUES.

The proportion of the sugar manufactured in Queensland which was required for consumption and use in the Commonwealth of Australia was declared at 57·781 per cent., and that for export at 42·219 per cent. These proportions are exclusive of the " excess " sugar produced by mills in excess of their allotments under the " Peak Year " scheme. The excess sugar produced for the season was 72,097 tons, as compared with 23,108 tons for the 1932 crop.

The price payable for the sugar required for consumption and use in Australia was declared at £23/18/6 per ton of 94 net titre. This was a reduction of £1/3/9 on the home consumption price of the previous season, and is £3/0/6 less than the 1932 value. This was due to the reduction of ½d. per lb. in the retail price of refined sugar, which operated from 5th January, 1933, the full effects of which were felt for the first time with the 1933 crop. The net value per ton of 94 net titre sugar sold abroad was £8/0/6, which is the lowest figure yet recorded.

The average price paid to those Queensland mills which did not produce " excess " sugar was £17/4/3 per ton of 94 net titre, compared with £19/16/1 for the 1932 crop. The average value of *all* sugar was £16/3/6 per ton, which is the lowest since 1914. The following figures show the values received by the industry per ton of 94 net titre sugar since 1924 :—

Year.	Price received. £ s. d.
1924	26 0 0
1925	19 10 7
1926	24 10 10
1927	22 0 4
1928	20 17 11
1929	20 5 10
1930	19 13 1
1931	18 6 6
1932	19 6 1
1933	17 4 3

The quantities of raw sugar which have been exported since 1924 (when the first large surplus was produced) and the price received therefor are as follows :—

Year.	Tons Bagged Sugar.	Price per ton. £ s. d.
1924	74,000	21 0 0 (approx.)
1925	219,000	11 5 9
1926	74,777	14 18 10
1927	152,384	12 2 6
1928	186,703	10 10 0
1929	197,000	9 17 0
1930	203,605	8 5 0
1931	291,802	9 7 0
1932	189,733	8 5 9
1933	305,687	8 0 6

The total value of the 1933 crop was £10,328,690.

General—continued.

CONCESSIONS TO FRUIT INDUSTRY.

The Chairman of the Fruit Industry Concessions Committee (Mr. A. R. Townsend), in his Third Annual Report (1934), states that the assistance granted by the sugar industry to the Australian fruit processors was as follows :—

Divisions.	Year 1933-34.
	£
(*a*) Domestic Sugar Rebates	58,488
(*b*) Export Sugar Rebates	60,372
(*c*) Financial Assistance for promoting use and sale of manufactured fruit products.. ..	118,859
Total	£237,719

The sugar industry thus contributes substantial sums towards the assistance of the fruit-growers of Australia ; all sugar used in exported processed goods is supplied to the manufacturer at world's parity.

ECONOMICS OF THE INDUSTRY.

The economic outlook has changed but little since the presentation of my last report. The 1934 crop promises to approximate very closely in yield to the record tonnage established in 1933, and again it is found necessary to export a large proportion of the sugar produced. The influence of seasonal variations has been to reduce the production in the far Northern mill areas, so that practically no " excess " sugar will be manufactured in those parts for the current year. A heavy increase in crop yields in the Southern areas has offset this reduction, in a large measure, and certain of the mills in this district have produced sugar in excess of the peak quota. This proportion would have been markedly increased had all available cane been crushed ; but many growers decided to cease harvesting when the quota had been reached, and an appreciable tonnage of cane will be allowed to stand over until 1935. In the Burdekin and Mackay areas, the sugar production will be in excess of the high tonnages recorded in 1933.

It may be argued that the abnormal crops of the past two years are the result of unusually favourable seasonal conditions. While this is true in part, it is also a fact that the pressure of economic circumstances is forcing the grower to pursue more vigorously methods of intensive production in order to reduce costs, with the result that a definite permanent increase in tonnage yields is inevitable. The adoption of improved fertilizer practices, the development of irrigation resources, and the planting of disease-resistant canes of superior yielding quality, each contribute to this effect. The progressive improvement in sugar yields per acre is clearly demonstrated by the following five-year period averages :—

Period.	Sugar per acre.
	Tons.
1919–1923	2·01
1924–1928	2·37
1929–1933	2·51

It is therefore certain that, so long as the present acreages remain under cultivation, the influence of these factors will become more acute. Seasonal fluctuations cannot, of course, be overlooked ; but any apparent relief afforded by unfavourable growing conditions must not be regarded with satisfaction. On the contrary, the coincidence of favourable climatic conditions in all districts might easily produce a yield of over 700,000 tons of sugar. At the present time, the prospects for the 1935 crop are everywhere most favourable.

That the industry regards the outlook with discomfiture is evidenced by the importance which was attached to the Conference of all sugar interests, convened by the Premier (the Hon. W. Forgan Smith) in January last. In his opening address, the Premier indicated the several aspects of the present problem of surplus production which should be considered by Conference, and urged the delegates to give careful thought to the questions of principle which were vital to the wellbeing of the industry, and on which the Government sought advice. The Conference was definitely agreed that the Peak Year Scheme as now existing should not be interfered with, and the claims for variations presented by certain mills were considered and disallowed. The problem of dealing with excess sugar was one on which some diversity of opinion existed, and the Premier referred this to the Conferences of the sugar organisations to be held in March.

General—continued.

The matter was duly considered, and both Conferences were unanimous in their desire to effect some plan whereby the progressive elimination of excess sugar could be achieved. The details of the method to be adopted were not established ; rather it was felt that as each mill area has its own peculiar conditions and problems, it could best be left to the local millowner and growers to devise an equitable plan of campaign. As might be anticipated, the diversity of views within the suppliers to any particular mill makes even this a complex problem. Certain districts have been able to finalise a scheme which is acceptable to the large majority of growers, but in others the formula is still under review. The difficulties which confront the canegrower—or any other primary producer, for that matter—in any scheme of restriction are great. It is not possible to regulate production in advance, except perhaps in those favoured localities where irrigation practice enables the producer to control yields within narrow limits ; and the constant fear that an unfavourable season may supervene to reduce his income below the economic minimum impels the grower to plant up a little extra area for safety. Should conditions prove favourable, a greater or less proportion of the crop must be allowed to stand over till the following year. Though such a plan may prove reasonably satisfactory in the Southern areas, standover crops are generally unprofitable ; in the far North, for example, they are devastated by borers, rats, and other pests, while with a crop which has arrowed freely heavy losses are inevitable.

At the present time, the restrictive plan which appears to find favour with the majority of canegrowers is some form of farm peak allocation. In certain areas, growers were able to agree on a " two pool " scheme which operated on the 1934 crop. By this plan, the individual grower is free to choose whether he will harvest his entire crop, or only that proportion which will enable the mill to fulfil its requirements for the Peak Year allocation (No. 1 pool). Any cane supplied over and above this quantity (No. 2 pool) will be paid for by the mill at a price to be determined by the net value realised for exported excess sugar. Though such a scheme provides a useful expedient when dealing with a difficulty which already exists, it is rather worthless as a long-range restrictive plan, for it offers a definite incentive for further expansion of production, as the recalcitrant grower is assured of the No. 1 pool price for at least a reasonable proportion of his increased crop.

It is confidently anticipated that in the near future something will have been effected to stem the tide of contracting values, which threaten to overwhelm a large proportion of Queensland sugar producers. The present drift of production can at best lead to profound hardships for those who are able to survive.

Work of the Bureau.

The detailed reports of the officers in charge of the several Divisions into which the activities of the Bureau fall are recorded in the subsequent pages of this Report. The following comments summarise the more important aspects of the year's accomplishments :—

Advisory Committee.

This Committee was constituted in July, 1933, at the request of the Honourable the Secretary for Agriculture and Stock, Mr. F. W. Bulcock. During the past year the Committee met on three occasions, and several matters of vital importance to the Bureau were discussed. At the meeting held in March, the Chairman announced his intention of introducing a Bill to amend " The Sugar Experiment Stations Acts, 1900 to 1923," to provide for an Advisory Board, constituted on the lines of the existing Committee. In order to enable the Government to give effect to certain of the recommendations of the Committee which involved increased expenditure from the Trust Fund, it was agreed that the amount of the Government Endowment would be limited to £7,000 per annum, and the balance of the expenditure would be contributed by the industry in the form of a levy on cane milled.

The Act has now been placed on the Statute Books, and its operations were put into effect with the framing of the 1934-35 estimates.

The action of the Minister in placing increased responsibility on the Industry, and in seeking the advice of its representatives in matters affecting the wellbeing of the Bureau, have been very well received ; and it is felt that this gesture will do much to effect closer co-operation with, and the more effective functioning of an organisation which can do much for the benefit of the sugar producers.

Transfer of Experiment Stations.

The question of the suitability of existing Experiment Stations was one which early engaged the attention of the Committee. It was decided that the Northern operations of the Bureau could be rendered more effective by co-ordinating all services through one Station located at Meringa. With the harvesting of the 1934 crop on the South Johnstone Station, the interests of the Bureau in that centre lapsed. A reserve adjacent to the existing Meringa Entomological Station was transferred to the control of the Agricultural Department for Sugar Experiment Station purposes, and new buildings are being provided to supplement those already in existence, so as to establish an up-to-date and efficient station for the pursuit of cane breeding, entomological and general agricultural research work. Early in 1935 these alterations will be complete, and the increased facilities provided will be greatly appreciated by the resident officers. The construction of a commodious glasshouse will assist very materially in the expansion of the seedling propagation work, which must be one of major projects at this centre. In addition, it paves the way for the inauguration of pot culture methods of soil fertility determination, which has been so favourably reported on from Hawaii.

The existing Mackay Station has always been a difficult location on which to effect satisfactory field experimental work. The irregularities in soil type and the restricted acreage suitable for experimentation render it desirable to seek a more suitable area for the purpose. Negotiations have now been finalised for the purchase of an area of Palms Estate, adjacent to the Te Kowai siding. The area of the selected block is approximately 70 acres, while the land must be regarded as a fair average sample of the cane lands of the Pioneer Valley. An early start will be made to transfer certain of the improvements from the present Station, and by the end of 1935 the new Station should be in satisfactory working order. The new site will provide the necessary facilities for permanent treatment plots, and enable an expansion of the seedling breeding work which should provide the improved disease-resistant canes for the central districts.

It was agreed that the Bundaberg Station is quite satisfactory for the purpose, and future efforts will be concentrated on the equipment of a chemical laboratory for research and general routine work. In addition, it is hoped that the small pumping plant at present being installed will enable an intensive study of irrigation problems to be made at that centre.

Staff.

Staff matters have been the subject of careful deliberation, and one of the chief problems is that of securing and retaining officers trained for the specialised work of the organisation. The strength of the Mill Technology staff in particular was a matter for concern, and the desirability of appointing a qualified consulting Engineer has been given special attention. The appointment

Work of the Bureau—continued.

of an Assistant Technologist (Mr. D. L. McBryde), enabled a more complete study of factors influencing sugar quality to be undertaken during the past season. The results of these investigations are embodied in the section of this Report devoted to that Division.

During the year the Divisions of Entomology and Pathology were merged, under the control of the Pathologist, Mr. A. F. Bell.

Mr. C. G. Hughes was appointed to the pathological staff early in 1934, while Mr. W. Cottrell-Dormer resigned to accept private employment; the vacancy thus created has not been filled. Mr. E. Jarvis was transferred to Head Office, and Mr. R. W. Mungomery has assumed the responsibility of the entomological investigations in the far North, with headquarters at Meringa. This leaves the Southern areas without the services of a resident entomologist, but it is considered that the nature of the pest problems in that region does not warrant an immediate appointment. At the same time, the position is being carefully supervised, and prompt action will be taken should the necessity arise.

Mr. F. W. Blackford was appointed as temporary field assistant for the calendar year, and he will resume his studies at the University in 1935. He has undergone a probationary period of training at Bundaberg and Cairns. It must again be pointed out that the weakest link on the agricultural side is our extension service, and it is, unfortunately, difficult to secure suitable men for positions in this branch. Until this situation is improved the effective dissemination of our research data cannot be effected.

The clerical staff of the Bureau has been added to by the appointment of Mr. C. A. Peel, junior clerk.

Headquarters Accommodation.

When extensions to the Department of Agriculture building were under consideration, advantage was taken of the opportunity to accommodate all laboratories and offices of the Bureau on one floor. The new building will be completed early in 1935, and the re-distribution of quarters will be a decided advantage. The re-arrangement has also enabled us to provide a mill technological laboratory, and thus relieve congestion in the agricultural division.

Publications.

A "Laboratory Manual" was compiled and published during the year, for the dual purpose of providing an elementary text-book for junior sugar chemists, and a reference book of standard analytical methods for the sugar mill laboratory. The publication has been well received by our mill technologists.

The "Cane Growers' Quarterly Bulletin" has appeared regularly, and canegrowers have expressed their keen appreciation of the opportunity which this booklet affords of transmitting to farmers the results of recent researches, in popular language.

Sugar Exhibits.

The combined sugar organisations agreed to present a display illustrative of the industry and its importance, at the 1934 Brisbane National Show. The display included a diorama which portrayed in a comprehensive manner the story of all phases of sugar production, as well as a technical exhibit of the work of the Bureau. A similar exhibit was prepared for the All Australian Exhibition held in Melbourne in connection with the Victorian and Melbourne Centenary celebrations. The exhibit was attractively staged in a novel setting, in which sugar cane provided the dominant note, and the value of the display as a means of educating the general public regarding the importance of the industry to Australia cannot be over-estimated.

Extension Service.

The important work of this branch of the service was continued and a further contribution of permanent value was secured from the results of the farm fertility trials which are carried out under the direct control of the field officers. In addition, the first series of comprehensive varietal trials were harvested during the 1934 crushing season. The results of these trials were published in the October issue of the "Cane Growers' Quarterly Bulletin," and they mark the culmination of the initial efforts of our Pathological staff to provide the Southern canegrowers with canes, both highly resistant to gumming disease and of superior growth and yielding qualities to the old standards.

Doubtless the investigational work of this nature could be extended profitably to embrace a wider range of soil and climatic conditions; but the restricted staff which is available for these duties is already overburdened with the projects in hand.

Work of the Bureau—continued.

Sugar Technological Societies.

The Queensland Society of Sugar Cane Technologists held a most successful Conference in Cairns, in March, 1934. The value of this organisation as a means of bringing together the technical workers of the industry is now fully appreciated, and the attendance at Cairns constitutes a record. It is very encouraging, also, to note the increased interest exhibited by the agriculturists in scientific agricultural developments, and the discussions in this section were generally of a high order.

In August, 1935, the International Society of Sugar Cane Technologists will meet in Brisbane, on the joint invitation of the Queensland Government and the several sugar organisations. This will be the first occasion on which such a gathering has been held in Australia, and the thorough preparations which are being made to receive the delegates from the leading cane-growing countries of the world should ensure the success of the Conference. The importance of such a gathering to the Queensland industry can be gauged from the calibre of the representatives who have attended the International Conferences in the past, and much good will result from the contacts which our scientific workers are able to make with the authorities from overseas.

Balance Sheet.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FROM 1st JULY, 1933, TO 30th JUNE, 1934.

Receipts.	£	s.	d.
To Balance, 1st July, 1933	11,902	9	2
To Assessments	9,720	16	2
„ Endowment	7,776	12	11
„ Bundaberg Station	461	4	5
„ Mackay Station	632	3	8
„ Johnstone Station	739	0	3
„ Gordonvale Station	24	10	3
„ Sundries	19	1	11
	£31,275	18	9

Disbursements.	£	s.	d.	£	s.	d.
By Salaries	..			6,766	17	2
„ Contingencies—						
Salaries and Wages	1,089	12	4			
Travelling Expenses, Hires, Fares, Freights, Allowances	2,219	2	5			
Apparatus, Furniture, Books, Installations ..	1,093	16	11			
Printing, Advertising, Stationery	1,232	2	7			
General Expenses	583	9	3			
				6,218	3	6
„ Bundaberg Contingencies	..			1,148	16	10
„ Mackay Contingencies	..			1,335	6	4
„ Johnstone Contingencies	..			1,467	11	6
„ Gordonvale Contingencies	..			1,666	18	1
„ Balance, 30th June, 1934	..			12,672	5	4
				£31,275	18	9

C.C.S. Formula.

For the benefit of foreign readers of this report the formula used for arriving at the commercial cane sugar (C.C.S.) in Queensland cane is given below :—

$$\text{C.C.S} = \frac{3P}{2}\left(1 - \frac{5+F}{100}\right) - \frac{B}{2}\left(1 - \frac{3+F}{100}\right)$$

where—P = pol. in first expressed juice
B = brix in first expressed juice
F = fibre in cane.

Division of Soils and Agriculture.

Farm Trials.

The farm fertility trial project was introduced in 1929. The results already reported have been of great value to those growers desirous of applying this knowledge in the more intelligent and economical use of fertilizers. In certain areas the type of mixture now widely used is entirely different from that which was formerly the standard preparation, and the application of the more suitable mixture is reflected in increased yields per acre together with increased financial returns on the money thus expended. During the year the Bureau issued a list of fertilizer mixtures which will in future form the basis of all fertility recommendations to canegrowers. The several distributing firms which operate in the cane areas have readily fallen in with the recommendations, and the "Sugar Bureau" planting and ratooning mixtures are now listed.

In addition to a further comprehensive series of fertility trials in all areas, a number of farm varietal trials were harvested in the Northern and Southern districts during the past season. In the former, an attempt was made to establish the value of the newly-adopted variety, S.J. 4, which was bred some years ago at the South Johnstone Experiment Station. The returns were reported in the "Cane Growers' Quarterly Bulletin," and they show that the new cane is definitely superior to the older selection of miscellaneous varieties which are grown on lands not suited to Badila. In the Southern districts certain of the canes which have proven highly resistant to gumming disease were found to outyield the older resistant standard (Q. 813) in all trials where the latter was included. Co. 290, P.O.J. 2725, and P.O.J. 234 appear destined to play a large part in the rehabilitation of the industry in the Southern districts.

The return of more favourable seasons in the Southern districts has provided an opportunity for gauging the plantfood deficiencies and productive capacity of the older soils in these parts. Phenomenal yields have been recorded on the irrigated plantations particularly. The results of all trials harvested during 1934 will be published in the January number of the "Cane Growers' Quarterly Bulletin."

Irrigation Research.

The important part played by irrigation in certain of our cane areas, and the conviction that this practice will become increasingly more popular in the near future, demand that careful attention be paid to the inter-relationships of soil and irrigation water. The installation of a modest pumping plant at the Bundaberg Station will facilitate this project, as well as provide an opportunity for demonstrating the value of the practice in areas of uncertain rainfall. The small-scale trial reported in the results of the experiments harvested from that Station during the 1934 season indicate the nature of the yields which might be expected in farm practice. Yields of this order were actually obtained on a field scale at Bingera Plantation; the records for a trial located within such a block will be found in the January "Bulletin."

Trash Conservation.

The trash conservation trials which were instituted on all Stations last year are being continued, although the work will be interrupted at Mackay and South Johnstone by the change in location of the Central and Northern Stations respectively. Parallel soil studies are being conducted in the laboratory with a view to determining more rapidly the influence of large additions of organic matter on the physical and chemical characteristics of the land. These are expected to indicate the nature of the ultimate results to be obtained from the field plots.

Maturity Testing.

Maturity tests proper have been discontinued as a research project on our Stations, due to pressure of other investigations. However, an interesting research on the influence of age of cane on maturity and c.c.s. has been carried through at Bundaberg, and the results of this work will be published at an early date. This has an important bearing on the time of planting in its relationship to c.c.s. in the Southern districts.

Cane Juice Phosphate.

In conjunction with the problem of clarification in those mills where canes deficient in phosphate form an important proportion of the crop, a survey of the soils and crops of the Mackay area has been commenced. Although it would be advantageous if the application of phosphatic fertilizers could be relied upon to fulfil the dual purpose of increasing crop yields and building up the inorganic phosphate content of the juice, it appears that little may be expected in this latter regard.

Division of Soils and Agriculture—continued.

Seedling Propagation.

The seedling technique which has now been developed with success at Mackay and Bundaberg has paved the way for a rapid expansion of the work ; and only the lack of field accommodation or irrigation plant capacity has curtailed an extension of the number propagated annually to some 15 or 20 thousands at each centre. This situation will be rectified for the coming year. The report of the Plant Breeder states that a selection of promising canes is now undergoing propagation for the purpose of farm yield trials under a wide range of soil and climatic conditions. The production of a series of seedlings of extraordinarily high sugar content encourages the hope that something phenomenal may be expected from the particular cross (Oramboo x H.Q. 409), which is being repeated as extensively as possible. One seedling has recorded a c.c.s. value of 22 per cent.

It is interesting to speculate on the value of such a variety in its influence on costs of production per ton of sugar. There is no phase of our work which offers such opportunities for spectacular result as that of plant-breeding ; though the progress of the geneticist is necessarily slow and tedious, the production of a single variety of outstanding characteristics might easily revolutionize the entire outlook of the industry.

Work of the Brisbane Laboratory.

The following is a summary of the analyses performed at the Brisbane laboratory for the year ended 31st October, 1934 :—

	No. of Samples.
Soils	261
Waters	37
By-products	21
Biological media	17
Limes and fertilizers	8
Sugar-canes	3
Sugars	2
Miscellaneous	4
Total	353

In addition, a considerable quantity of laboratory glassware and apparatus was standardized on behalf of the Division of Mill Technology.

During the year studies were completed of the relationship between field trial results and laboratory soil tests. There appears to be a definite value in the latter, and it is hoped that the results of further trials will enable the precise class limits to be stated with accuracy. Complete fusion analyses of 43 major soil types taken from all sections of the cane belt have been finalised, and are being prepared for publication.

The problems of trash decomposition and phosphate fixation in the soil are at present being studied in the laboratory.

Work of the Experiment Stations.

Reports prepared by the Chemists in charge of the three stations will be found in the following pages, together with a summary of the year's work in seedling propagation by the Plant Breeder.

SEEDLING PROPAGATION.

E. J. R. Barke, Cane Breeder.

The cross pollination work, for the past season, was carried out both at the Northern Sugar Experiment Station, South Johnstone, and at the Freshwater Sub-station, Cairns. The cane arrowed early and freely, and the percentage of viable pollen was considerably above normal. Weather conditions were good throughout the crossing season, the average relative humidity at South Johnstone being 86.2%, and at Freshwater 83.5%. The total number of different combinations made amounted to 68, which were comprised of 58 new trial marriages, and 10 of the most promising crosses used in previous trials.

Crosses carried out during the Breeding Season, 1934—South Johnstone and Freshwater.

New Trial Marriages.

Female.	Male.
P.O.J. 2725	P.O.J. 2940, S.J. 12c, S.J. 52c, Q. 1098, Black Innis.
P.O.J. 2878	Co. 290, S.J. 12c, S.J. 50c, Q. 1098, S.J. 82d, S.J. 164d, Black Innis
P.O.J. 2722	S.J. 52c, D. 1135
P.O.J. 2364	S.J. 12c, S.J. 52c, Black Innis
P.O.J. 234	Q. 1098
P.O.J. 100	S.C. 12 (4), P.O.J. 2940, D. 1135, S.J. 12c, Black Innis
Co. 281	S.J. 50c, E.K. 28
Co. 290	Q. 1098, S.J. 12c, Oramboo
S.J. 4	H. 456, Co. 290, S.W. 499
N.G. 16	S.W. 499
7R428	P.O.J. 2940
Oramboo	Co. 290, N.G. 24, H. 456, S.J. 82c, S.J. 248c, S.J. 7d, S.J. 16d, S.J. 20d, S.J. 3c.
S.J. 164c	S.C. 12 (4), S.J. 7d, S.J. 16d, S.J. 20d, S.J. 664b.
Kassoer	Q. 1098, S.J. 7d.
Korpi	S.C. 12 (4), S.J. 16d.
Q. 813	E.K. 28, S.J. 458c
N.G. 15	S.J. 3c, S.J. 459c, S.J. 872c, S.J. 20d, S.J. 68d
S.J. 7	S.J. 68d

Selected Combinations from Previous Trials.

Female,	Male.
Oramboo	H.Q. 409, S.C. 12 (4), Q. 813, E.K. 28
N.G. 15	Q. 813, P.O.J. 2878, S.C. 12 (4)
P.O.J. 2878	P.O.J. 2940, S.C. 12 (4), S.J. 102c

Seedling Propagation—continued.

Selections from 1933 Crossings.

Parents. ♀ × ♂	Selected.	Average Brix.
	Per cent.	Per cent.
Badila × S.C. 12 (4)	1·5	21·8
Badila × P.O.J. 2878	1·2	21·0
Badila × P.O.J. 2940	3·5	19·9
N.G. 16 × Q. 813	0·6	21·5
N.G. 16 × P.O.J. 2878	0·5	20·1
N.G. 24 × S.C. 12 (4)	3·1	21·8
N.G. 24 × Q. 813	1·2	22·1
P.O.J. 213 × H. 1541	0·2	21·2
P.O.J. 2364 × Badila	0·6	20·2
P.O.J. 2364 × H.Q. 409	1·0	20·7
P.O.J. 2722 × H. 1541	0·5	21·0
P.O.J. 2722 × P.O.J. 2940	0·2	20·2
P.O.J. 2722 × H.Q. 409	0·7	20·8
P.O.J. 2722 × Ewa 371	0·8	20·6
P.O.J. 2725 × S.C. 12 (4)	2·4	20·4
P.O.J. 2725 × S.W. 499	1·2	20·3
P.O.J. 2725 × S.J. 3c	0·5	20·8
P.O.J. 2725 × S.J. 2c (F)	0·2	21·6
P.O.J. 2725 × S.J. 142D	0·4	20·8
P.O.J. 2725 × Co. 281	1·2	20·6
P.O.J. 2878 × P.O.J. 2940	4·0	21·0
P.O.J. 2878 × S.C. 12 (4)	1·2	21·4
P.O.J. 2878 × S.J. 1c	0·2	21·2
P.O.J. 2878 × S.J. 3c	0·4	20·0
P.O.J. 2878 × S.J. 6c	0·5	20·4
P.O.J. 2878 × S.J. 88c	0·2	20·2
P.O.J. 2878 × H. 2265	0·4	20·6
P.O.J. 2878 × M. 189	0·5	20·6
Co. 281 × E.K. 28	0·2	19·8
U.D. 1 × E.K. 28	0·02	19·6
U.D. 75 × S.J. 3381c	0·8	20·8
U.D. 110 × S.J. 1c	0·2	19·3
Zwinga × S.J. 3c	4·0	19·8
S.J. 14A × S.C. 12 (4)	2·5	21·5
S.J. 4 × P.O.J. 2940	0·5	20·0
S.J. 4 × S.C. 12 (4)	0·2	20·8
M. 189 × S.C. 12 (4)	0·06	20·7
S.J. 146D × S.J. 2c	1·5	22·4
S.J. 172D × S.J. 2c	0·8	21·6
S.J. 188D × S.J. 2c	1·0	22·4
S.J. 194D × S.J. 2c	0·4	21·8
S.J. 198D × S.J. 2c	2·0	22·6

Seedling Propagation—continued.

Selections from 1933 Crossings—continued.

Parents. ♀	♂	Selected.	Average Brix.
		Per cent.	Per cent.
Oramboo	S.C. 12 (4)	1·2	22·4
Oramboo	Q. 813	2·5	22·4
H.Q. 409	S.C. 12 (4)	0·2	20·0
S.J. 182D	H.Q. 409	0·05	20·8
B. 208	S.C. 12 (4)	8·2	21·5

Second Selections of 1932 Seedlings.

The second year selections of the 1932 seedlings were carried out during the months of July and August, and 25 canes were chosen.

The examinations in July comprised juice analysis, while in August, juice analysis, weight of stool, disease resistance, and general habits were considered.

The results of the selected seedlings are set out below :—

Seedling.	Parents. ♀	♂	C.C.S.	Weight per Stool.
			Per cent.	Lb.
1E	N.G. 15	P.J.O. 2878	15·4	36
2E	N.G. 15	S.C. 12 (4)	15·6	39
3E	N.G. 15	S.C. 12 (4)	16·4	29
4E	N.G. 15	S.C. 12 (4)	16·2	32
5E	N.G. 15	Q. 813	16·8	28
6E	N.G. 15	Q. 813	17·2	26
7E	N.G. 15	Q. 813	16·4	30
8E	N.G. 15	Q. 813	16·4	32
9E	N.G. 15	Q. 813	16·8	34
10E	N.G. 16	Q. 813	16·1	29
11E	N.G. 16	P.O.J. 2940	15·6	38
12E	P.O.J. 2878	P.O.J. 2940	15·2	41
13E	P.O.J. 2878	S.J. 102C	15·8	29
14E	P.O.J. 2878	S.J. 32D	15·5	26
15E	P.O.J. 2725	S.C. 12 (4)	14·7	28
16E	P.O.J. 2725	Q. 813	14·8	30
17E	P.O.J. 2725	H.Q. 409	15·0	24
18E	Oramboo	H.Q. 409	18·4	22
19E	Oramboo	H.Q. 409	17·5	21
20E	Oramboo	H.Q. 409	16·8	26
21E	Oramboo	H.Q. 409	16·8	29
22E	Oramboo	H.Q. 409	16·7	24
23E	Oramboo	H.Q. 409	16·9	22
24E	Oramboo	Q. 813	16·4	24
25E	Oramboo	S.C. 12 (4)	16·8	27

Seedling Propagation—continued.

Final Selection of all Seedlings from 1927 to 1931.

The following seedlings have been taken into the permanent collection, and have received "Q" numbers which will be used in future to designate final selections on all Queensland Stations :—

Seedling.	Parents. (♀ × ♂)	C.C.S.	Tons of Cane per Acre.
		Per cent.	
Q.1	Oramboo × H.Q. 409	22·1	29·4
Q.2	S.J. 684A × S.J. 642C	21·0	27·5
Q.3	P.O.J. 2878 × S.J. 86A	16·1	37·2
Q.4	P.O.J. 2878 × S.J. 672B	14·2	51·4
Q.5	P.O.J. 2364 × S.J. 267A	14·0	47·5
Q.6	N.G. 15 × S.J. 148A	16·7	38·5
Q.7	N.G. 15 × S.J. 274A	16·3	42·7
Q.8	N.G. 15 × S.J. 662B	15·8	46·4
Q.9	S.J. 848A × S.J. 3C	16·4	35·9
Q.10	S.J. 42B × S.J. 3C	16·7	32·8
Q.11	S.J. 298C × S.J. 1C	16·0	37·4
Q.12	S.J. 298C × S.J. 269D	16·5	36·0

Pedigrees of Most Promising Seedlings—

Of the above final selections, Q.1, Q.3, Q.4, and Q.5 are the most promising, and are now being propagated for field trial under a wide range of environmental conditions. The pedigrees of these four seedlings are as follows :—

Q.1— Oramboo × H.Q. 409.

Q.3— P.O.J. 2364 × E.K. 28 ↓ P.O.J. 2878 × Badila × S.C. 12(4) ↓ S.J. 86A. → ↓ Q.3.

Q.4— P.O.J. 2364 × E.K. 28 ↓ P.O.J. 2878 × Badila × S.C. 12 (4) ↓ S.J. 102A × Badila ↓ S.J. 672B → ↓ Q.4.

Q.5— Rose Bamboo × S.C. 12 (4) ↓ S.J. 267A; P.O.J. 2364 × S.J. 267A → ↓ Q.5.

Third Nobilization of S. Spontaneum and S. Robustum—

The third nobilization of the wild cane varieties, S. Spontaneum and S. Robustum, was carried out during the season of 1933, and a number of promising canes have been obtained. In general these canes are vigorous and large stooling, but their sucrose content is still below that of our standard variety, Badila.

Inter-generic Crosses—

This work will be taken up again on the arrival of further introductions of Erianthus from Hawaii.

Selections from Self-fertilized Lines as future Breeding Parents—

The continuation of this work is producing some promising results, and the data from the 1934 crossing season is now required to complete the first phase of this study.

Seedling Propagation—continued.

Seedling Work at Mackay and Bundaberg

Mackay—

The total number of seedlings raised at the Mackay Station up to the 1933 season is 18,761. From this number 1.4% have been selected, and several of these show distinct promise. Stocks are now being propagated for extensive trial purposes. In all, some 54 different parentage combinations have been tested, and from these 22 have yielded promising seedlings; from the remaining 32, all progeny have been discarded.

A summary of the crosses from which promising seedlings have been obtained, after two or more selections, are as follows:—

Cross.	Number 1st Selection.	Number Final Selection.
Badila × E.K. 28	8	2
S.J. 4 × S.C. 12 (4)	4	1
N.G. 16 × S.C. 12 (4)	17	3
N.G. 24 × Q. 813	3	1
N.G. 24 × S.C. 12 (4)	11	4
Badila × S.C. 12 (4)	6	3
P.O.J. 2878 × S.C. 12 (4)	17	8
N.G. 16 × P.O.J. 2878	8	1
7R428 × S.J. 4	1	1
N.G. 16 × H.Q. 409	12	1
S.J. 4 × S.W. 499	3	1

The following table sets out the crosses tested during the 1933–34 season and the number of selected seedlings:—

1933–1934 Seedlings.

Cross.	Number Planted in Field.	Number 1st Selection.
P.O.J. 2878 × S.C. 12/4	690	4
P.O.J. 2875 × P.O.J. 2940	524	12
N.G. 16 × D. 1135	272	8
P.O.J. 2878 × P.O.J. 2940	192	9
P.O.J. 2940 × S.C. 12/4	544	9
P.O.J. 2875 × H.Q. 409	121	3
P.O.J. 2725 × D. 1135	77	1
N.G. 16 × S.C. 12/4	284	1
N.G. 16 × H.Q. 409	259	1
Pompey × H.Q. 409	824	22
P.O.J. 2725 × S.C. 12/4	466	14
Badila × E.K. 28	70	Nil
P.O.J. 2722 × W. 4	63	Nil
P.O.J. 2878 × D. 1135	500	Nil
P.O.J. 2364 × D. 1135	620	Nil
Total	5,506	84

During the 1934 season 6,500 seedlings have been planted in the field,

Seedling Propagation—continued.

Bundaberg—

During the 1933 season, 4,000 seedlings were planted in the field, and from this number 287 seedlings, representing 7%, were selected. The most promising seedlings were obtained from the crosses P.O.J. 2878×S.C. 12 (4), P.O.J. 2875×H.Q. 409, P.O.J. 2722×P.O.J. 2940, and Co. 281×E.K. 28. The varieties Q. 813 and P.O.J. 234 were used as the standards of comparison for seedling selections, and all canes with a circumference of less than three inches were discarded. A third selection of the 1930 and 1931 seedlings resulted in 12 being retained, and these canes have now been set out in gum resistance trials.

The second selection of the 1932 seedlings eliminated all but 71 canes, and these have been planted out in further observational trials. The most promising combinations in this series are P.O.J. 2875×H.Q. 409, P.O.J. 2878×H.Q. 409, and Co. 290×S.C. 12 (4); the Co. 290×S.C. 12 (4) progeny are the most outstanding.

For the season 1934, 6,000 seedlings have been planted in the field, and they represent progeny from the following combinations :—Oramboo×S.J. 862c, P.O.J. 2725×S.J. 32c, P.O.J. 2725×Black Innis, P.O.J. 2725×S.C. 12 (4), P.O.J. 2725×S.J. 11c, P.O.J. 2878×S.C. 12 (4), P.O.J. 2878×P.O.J. 2940, Co. 281×E.K. 28, Co. 281×S.J. 50c, Co. 290×Q. 1098, Co. 290×S.J. 16c, S.J. 48c×Co. 290, N.G. 24×Co. 290, S.J. 4×P.O.J. 2940, N.G. 16×S.W. 499, N.G. 16×P.O.J. 2940, P.O.J. 2722×D. 1135, Oramboo×S.C. 12 (4), and Pompey×P.O.J. 2940.

An appreciable number of seedlings are infected naturally with gumming disease, and all canes showing numerous gum streaks are discarded, irrespective of quality and other commendable features. A series of gumming resistance trials, comprising the progeny of all "Trial Marriages" and selected seedlings is carried out each year by the Pathologist, Mr. A. F. Bell.

NORTHERN SUGAR EXPERIMENT STATION, SOUTH JOHNSTONE

Mr. E. J. R. Barke, Chemist in Charge.

METEOROLOGICAL.

The growing season of the 1933–34 sugar-cane crop was not so favourable as that of the preceding year. The rainfall was the highest on record, the total amounting to 225.45 inches, which was distributed over a period of 237 wet days. The long wet season caused considerable water logging of the soil, and prevented cultivation and weed control. These factors, together with the reduced amount of sunlight, caused a decrease in the tonnage of cane per acre to a figure considerably below the average for this district. The situation was further aggravated by a heavy arrowing of all crops—both advanced and backward.

The following are the rainfall records taken at this Station since the year 1919 :—

Year.	Rainfall in inches.	Year.	Rainfall in inches.
1919	97·61	1927	138·11
1920	123·92	1928	118·63
1921	202·52	1929	129·53
1922	107·14	1930	145·54
1923	84·78	1931	137·26
1924	146·71	1932	138·76
1925	118·94	1933	169·43
1926	77·50	1934 (9 months) ..	164·98

Abstract of Meteorological Observations made at the Northern Sugar Experiment Station, South Johnstone, from the 1st September, 1933, to 31st August, 1934 Covering Period of Growth of Experiment Canes.

Month.	Rainfall in Inches.	Number of Wet Days.	Average Rainfall, 14 Years, 1920–1933.	Highest Shade Maximum.	Lowest Shade Maximum.	Mean Shade Maximum.	Highest Shade Minimum.	Lowest Shade Minimum.	Mean Shade Minimum.	Lowest Terrestrial Minimum.	Mean Terrestrial Minimum.	Mean Diurnal Range.	Mean Temperature, 9 a.m.	Mean Relative Humidity of the Air, 9 a.m.
September, 1933	7·17	21	3·47	87·0	76·0	82·2	71·0	55·5	65·0	54·2	64·0	17·2	74·7	82·0
October, 1933..	11·21	18	4·05	88·0	76·5	84·0	70·5	57·0	64·8	55·6	63·2	19·2	77·1	77·2
November, 1933	22·63	22	5·61	92·5	80·5	86·8	73·0	62·5	69·0	60·8	67·5	17·8	81·3	77·8
December, 1933	19·46	20	11·89	97·5	82·0	89·1	74·0	65·0	70·0	63·5	68·5	19·1	81·9	81·0
January, 1934	33·74	25	21·20	94·5	83·0	86·9	74·5	64·0	71·6	62·6	70·0	15·3	81·3	87·0
February, 1934	31·55	25	22·04	92·5	83·5	87·6	74·0	68·0	71·6	66·1	70·2	16·0	79·9	85·8
March, 1934 ..	34·92	24	27·12	93·2	84·5	88·8	75·0	64·5	71·2	62·8	70·0	17·6	81·0	88·2
April, 1934 ..	30·34	20	15·48	93·8	80·0	85·0	74·0	62·0	69·0	60·5	67·2	16·0	75·6	85·6
May, 1934 ..	19·88	22	10·97	88·0	77·2	82·2	68·8	56·6	63·2	55·0	61·0	19·0	73·7	83·8
June, 1934 ..	7·91	12	7·06	82·5	69·5	75·0	69·1	47·4	60·0	46·0	59·0	15·0	68·0	81·8
July, 1934 ..	4·83	20	3·86	82·2	68·8	74·8	68·5	47·8	60·2	45·5	59·0	14·6	68·2	78·0
August, 1934 ..	1·81	8	3·20	84·0	70·0	75·4	68·0	47·2	61·0	45·0	59·5	14·4	68·8	70·0
Year ..	225·45	237	135·95	..	..	..	..	..	..	..	..	..	..	*81·5

*Average.

Work of the Northern Sugar Experiment Station—continued.

Experiments Harvested during 1934.

1. *Fertilizer experiment.*—Value of phosphates in different fertilizers and time of application—Third ratoon crop.
2. *Molasses and fertilizer experiment.*—Second ratoon crop.
3. *Varietal and fertility trial.*—First ratoon crop.
4. *Fertilizer experiment.*—Amounts of nitrogen, phosphoric acid, and potash—Plant crop.
5. *Stubble Shaver Experiment.*—Third ratoon crop.

FERTILIZER EXPERIMENT—VALUE OF PHOSPHATES IN DIFFERENT FERTILIZERS AND TIME OF APPLICATION (Third Ratoon Crop).

Plan and Yields.

Blocks	I.	II.	III.	IV.	V.
	N Ps K Early 37.8	N Pm K Early 33.6	N Pb K Early 30.2	N Ps K Late 27.2	N Ps K Early 30.8
	N Pm K Early 36.4	N Pb K Early 37.9	N Pb K Late 25.7	N Pb K Late 25.0	N Pb K Late 27.1
	N Pb K Late 34.6	N Ps K Late 26.2	N Pm K Early 26.5	N Ps K Early 27.7	N Pm K Early 27.0
	N Pm K Late 33.0	N Ps K Early 30.8	N Ps K Late 26.0	N Pb K Early 27.2	N Pb K Early 28.0
	N Pb K Early 36.1	N Pb K Late 27.8	N Ps K Early 28.8	N Pm K Early 29.2	N Ps K Late 25.5
	N Ps K Late 35.4	N Pm K Late 31.6	N Pm K Late 27.5	N Pm K Late 28.6	N Pm K Late 29.0

Block.—A1.

Variety.—Badila.

Harvested.—July, 1934.

Age of Crop.—11 months.

System of Replication.—Five randomised blocks.

Plots.—0·065 acre.

TREATMENT.

(1.) *Fertilizer*—

Ps—400 lb. superphosphate per acre.

Pb—467 lb. basic-superphosphate containing P_2O_5 equivalent of 400 lb. superphosphate per acre.

Pm—177 lb. monammonium phosphate, containing P_2O_5 equivalent of 400 lb. superphosphate per acre.

In addition—all plots received uniform dressings of nitrogen in the form of sulphate of ammonia.

(2.) *Time of Application*—

Early—In furrow at time of ratooning.

Late—Two months after ratooning.

CULTIVATION OF LAND.

Plant Crop.—A heavy crop of Mauritius Bean was ploughed under in March, and, after decomposition of organic matter, the land was ploughed and harrowed twice. Cane was planted in May, 1930.

Ratoon Crops.—The plots were ratooned by ploughing away from the stubble and breaking the centre with a skeleton plough to a depth of 12 inches.

Work of the Northern Sugar Experiment Station—continued.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (Mean Square).
Blocks	4	298·59	74·65	..
Quality of phosphate	2	1·93	0·97	1·1361
Time of application	1	47·63	47·63	3·0831
Errors	22	94·26	4·28	1·8782
Total	29	442·41	..	..

Crop Yields.

	Form of Phosphate.			Time of Application.	
	Superphosphate.	Basic Superphosphate.	Monammonium Phosphate.	Early.	Late.
Cane, tons per acre	**29·62**	**29·96**	**30·24**	**31·20**	**28·68**
Cane, percentage of mean yield	98·9	100·1	101·0	104·2	95·8
C.C.S. in cane, per cent.	**15·0**	**15·0**	**15·0**	**15·0**	**15·0**
C.C.S., tons per acre	**4·44**	**4·49**	**4·54**	**4·68**	**4·30**
Standard Error	2·18 per cent.			1·78 per cent.	

Summary of Crop Yields—Plant, First, Second, and Third Ratoons.

Treatment.	Plant Crop.			First Ratoon Crop.			Second Ratoon Crop.			Third Ratoon Crop.		
	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	%	Tons.	Tons.	%	Tons.	Tons.	%	Tons.	Tons.	%	Tons.
Phosphate as—												
Superphosphate ..	**46·2**	16·1	**7·44**	**31·8**	16·2	**5·15**	**35·0**	16·0	**5·60**	**29·6**	15·0	**4·44**
Basic superphosphate..	**46·4**	16·1	**7·47**	**31·5**	16·3	**5·13**	**34·4**	16·0	**5·50**	**30·0**	15·0	**4·50**
Monammonium phosphate	**46·2**	16·1	**7·44**	**32·5**	16·3	**5·30**	**35·6**	15·9	**5·66**	**30·2**	15·0	**4·53**
Fertilizer applied—												
Early	**46·7**	16·2	**7·56**	**32·7**	16·3	**5·33**	**36·1**	15·9	**5·74**	**31·2**	15·0	**4·68**
Late	**45·9**	16·1	**7·39**	**31·1**	16·2	**5·04**	**33·9**	16·0	**5·42**	**28·7**	15·0	**4·31**

CONCLUSIONS.

This experiment has been carried through four successive crops, and is now concluded. The results have shown consistently that the three forms of phosphate employed are equally efficient, on the basis of equivalent proportions of phosphoric acid. Superphosphate is therefore recommended for general use by virtue of its lower unit cost.

As regards time of application of the manure, it is interesting to observe that the earlier dressings have consistently given the best results, and this has been increasingly more marked with successive ratoon crops. The percentage crop increases for early over latter applications were :—

Plant cane	1·7%
First ratoons	5·0%
Second ratoons	6·3%
Third ratoons	8·3%

Work of the Northern Sugar Experiment Station—continued.

MOLASSES AND FERTILIZER EXPERIMENT (Second Ratoon Crop).

Plan and Yields.

Fertilizer	**Check**	**Molasses**
21.75	**15.45**	**20.50**
Check	**Molasses**	**Fertilizer**
16.25	**19.13**	**18.20**
Molasses	**Fertilizer**	**Check**
23.25	**18.50**	**15.75**

Block.—A3.

Variety.—Badila.

Harvested.—July, 1934.

Age of Crop.—11 months.

System of Replication.—3 x 3 Latin square.

Plots.—One-tenth acre.

TREATMENTS.

Plant Crop.

Molasses.—Ten tons per acre applied broadcast and allowed to decompose before planting.

Fertilizer.—The following fertilizer equivalent in plant-food content to 10 tons of molasses :—

1,010 lb. sulphate of ammonia per acre ;
165 lb. superphosphate per acre ;
860 lb. sulphate of potash per acre.

The superphosphate, sulphate of potash, and one-third of the sulphate of ammonia were applied broadcast before planting. The remainder of the sulphate of ammonia was applied in two equal dressings after the crop had been planted, at intervals of six weeks.

Check.—No treatment.

First and Second Ratoon Crops.

No further applications of molasses or fertilizer were made, and the cane was ratooned in the usual manner.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Rows	2	3·60	1·80	..
Columns	2	12·76	6·38	..
Treatments	2	42·08	21·04	2·6745
Errors	2	0·51	0·26	0·4778
Total	8	58·95	..	..

Crop Yields.

—	Check.	10 tons Molasses per acre.	Fertilizer equivalent to 10 tons Molasses per acre.
Cane, tons per acre	**15·82**	**20·96**	**19·48**
Cane, percentage of mean yield	84·4	111·8	103·9
C.C.S. in cane, per cent.	**15·8**	**15·6**	**15·7**
C.C.S., tons per cane	**2·50**	**3·27**	**3·06**

Standard Error .. .. **1·56** per cent.

Work of the Northern Sugar Experiment Station—continued.

Summary of Crop Yields—Plant, First, and Second Ratoon Crops.

—	Plant Crop.			First Ratoon Crop.			Second Ratoon Crop.		
	Check.	10 Tons Molasses per Acre.	Fertilizer Equivalent to 10 Tons Molasses per Acre.	Check.	10 Tons Molasses per Acre.	Fertilizer Equivalent to 10 Tons Molasses per Acre.	Check.	10 Tons Molasses per Acre.	Fertilizer Equivalent to 10 Tons Molasses per Acre.
Cane, tons per acre ..	28.4	41.3	38.3	30.2	41·2	42.7	15.8	21.0	19.5
C.C.S. in cane, per cent. ..	16.0	15.3	15.6	15.6	15.3	15.3	15.8	15.6	15.7
C.C.S., tons per acre ..	4.54	6.32	5.97	4.71	6.30	6.53	2.44	3.27	3.04

CONCLUSIONS.

The only plant-food treatments which the soil received were the initial applications of molasses and fertilizer prior to planting. The yield increases over the three crops were as follows :—

—	Due to—	
	Molasses.	Fertilizer.
	Tons.	Tons.
Plant cane	12·9	9·9
First ratoons	11·0	12·5
Second ratoons	5·2	3·7
Total increase	29·1	26·1

It is therefore seen that the influence of the molasses treatment has extended over three years, though the residual effect on the second ratoon crop was much less than on the preceding crops. In the aggregate it appears also that molasses has been superior in its benefits to the equivalent of plant-food applied as artificial manures.

The results of this trial, particularly when taken in conjunction with those of similar experiments at Mackay and Bundaberg, stress the value of molasses as a most suitable material for rejuvenating old lands. It is pleasing to note that the utilization of molasses for this purpose is increasing annually, but there are still large quantities in certain mill areas which could be diverted for use in this manner.

Work of the Northern Sugar Experiment Station—continued.

VARIETAL AND FERTILITY TRIAL (First Ratoon Crop).

Plan and Yields.

I.	POJ 2878 NP 36.2	NG 15 2N 2P 28.4	POJ 2878 2N P 39.2	NG 15 N 2P 27.0
	NG 15 2N P 29.4	POJ 2878 N 2P 37.4	NG 15 NP 24.3	POJ 2878 2N 2P 41.0
II.	POJ 2878 N 2P 37.1	NG 15 2N P 36.4	POJ 2878 2N 2P 40.5	NG 15 NP 26.8
	NG 15 2N 2P 29.3	POJ 2878 NP 35.6	NG 15 N 2P 28.1	POJ 2878 2N P 40.2

Block.—B1.

Varieties.—Badila (N.G. 15) and P.O.J. 2878.

Harvested.—July, 1934.

Age of Crop.—10 months.

System of Replication.—Two randomised blocks.

Plots.—0·146 acre.

TREATMENTS.

Fertilizer.—All plots received 150 lb. muriate of potash per acre.

N—300 lb. sulphate of ammonia per acre.

2N—600 lb. sulphate of ammonia per acre.

P—300 lb. superphosphate per acre.

2P—600 lb. superphosphate per acre.

CULTIVATION.

The plots were ratooned by ploughing away from the stubble and breaking the interspaces to a depth of 12 inches with the skeleton plough.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (Mean Square).
Blocks	1	7·70	7·70	..
Varieties	1	375·39	375·39	5·2667
Nitrogen (N.)	1	63·60	63·60	4·3790
Phosphate (P.)	1	0·03	0·03	0·5493
Errors	11	45·63	4·15	3·0141
Total	15	492·35	..	..

Crop Yields.

——	Badila.	P.O.J. 2878	Sulphate of Ammonia.		Superphosphate.	
			300 lb.	600 lb.	300 lb.	600 lb.
Cane, tons per acre	**28.7**	**38.4**	**31.6**	**35.5**	**33.5**	**33.6**
Cane, percentage of mean yield	85·6	114·4	93·9	106·1	99·9	100·1
C.C.S. in cane, per cent.	**14.0**	**11.1**	**12.8**	**12.3**	**12.5**	**12.5**
C.C.S., tons per acre	**4.02**	**4.26**	**4.03**	**4.37**	**4.19**	**4.20**

Standard Error .. .. **2.15** per cent.

Work of the Northern Sugar Experiment Station—continued.

Summary of Crop Yields—Plant and First Ratoon Crops.

—	Plant Crop.						First Ratoon Crop.					
	Badila.	P.O.J. 2878.	Sulphate of Ammonia.		Superphosphate.		Badila.	P.O.J. 2878.	Sulphate of Ammonia.		Superphosphate.	
			300 lb.	600 lb.	300 lb.	600 lb.			300 lb.	600 lb.	300 lb.	600 lb.
Cane, tons per acre	**33.6**	**36.8**	**33.3**	**37.1**	**34.5**	**35.9**	**28.7**	**38.4**	**31.6**	**35.5**	**33.5**	**33.6**
Cane, percentage of mean yield ..	95·4	104·6	94·6	105·4	98·0	102·0	85·6	114·4	93·9	106·1	99·9	100·1
C.C.S. in cane, per cent.	**15.3**	**13.2**	**14.5**	**14.0**	**14.3**	**14.3**	**14.0**	**11.1**	**12.8**	**12.3**	**12.5**	**12.5**
C.C.S., tons per acre	**5.14**	**4.86**	**4.83**	**5.19**	**4.93**	**5.13**	**4.02**	**4.26**	**4.04**	**4.37**	**4.19**	**4.20**

CONCLUSIONS.

Badila v. P.O.J. 2878.—In the plant crop, the Javan cane outyielded Badila by 3 tons of cane per acre; but the c.c.s. value of the former was 2 units below that of the North Queensland standard. In the ratoons, the remarkable ratooning quality of the P.O.J. canes was demonstrated by the fact that P.O.J. 2878 outyielded Badila by some 10 tons per acre. The c.c.s. was, however, even more disappointing than in the plant crop, for Badila was 3 units higher than the Javan cane. Certainly both crops were harvested while immature, but the disparity in sugar content bears out previous experience in this regard. Having regard for the top-rot and downy mildew susceptibility of P.O.J. 2878, it must be concluded that the cane is not suited for average North Queensland conditions.

Nitrogen.—The value of the heavier dressing of sulphate of ammonia (600 lb. per acre) was again demonstrated in the ratoon crop; the increase in yield over the single application (300 lb. per acre) was 4 tons. As is usual with heavy dressings of nitrogenous manures, there was a depression in c.c.s. value due to the extra sulphate of ammonia; probably this would have been minimised, had the crop been harvested at maturity. These results, in conjunction with those previously obtained at South Johnstone, suggest that 400 lb. of sulphate of ammonia per acre provide the optimum application for soils of this type on first ratoon cane.

Phosphate.—The application of 300 lb. of superphosphate per acre was equally as effective as the heavier dressing (600 lb.). This is rather an unusual result, in the light of previous experience on this soil type, and may be related to the extraordinary growing season experienced.

Work of the Northern Sugar Experiment Station—continued.

FERTILIZER EXPERIMENT—AMOUNTS OF NITROGEN, PHOSPHORIC ACID, AND POTASH (PLANT CROP).

Block.—B5.
Variety.—P.O.J. 2878.
Harvested.—July, 1934.
Age of Crop.—13 months.
System of Replication.—Three randomised blocks.
Plots.—0·107 acre.

Plan and Yields.

3N 2P 2K	3N 3P 2K	3N 2P K	3N 3P 2K	3N 2P K	3N 3P 2K
51.3	49.6	43.8	48.8	47.8	48.2
2N 2P K	3N 3P K	2N 3P 2K	3N 2P K	2N 2P 2K	2N 3P K
44.6	50.2	44.5	48.0	42.3	44.1
2N 3P 2K	2N 3P K	2N 2P 2K	3N 3P K	2N 3P 2K	3N 3P K
47.0	46.0	45.2	46.5	43.5	47.0
3N 2P K	2N 2P 2K	2N 3P K	3N 2P 2K	2N 2P K	3N 2P 2K
48.4	45.0	47.2	48.2	42.6	48.4
Blocks I.		II.		III.	

TREATMENTS.

Fertilizer.—
2N—400 lb. sulphate of ammonia per acre.
3N—600 lb. sulphate of ammonia per acre.
2P—600 lb. superphosphate per acre
3P—900 lb. superphosphate per acre.
1K—150 lb. muriate of potash per acre.
2K—300 lb. muriate of potash per acre.

PREPARATION OF LAND.

A good crop of Poona Pea was ploughed under in March, and, after decomposition of organic matter, the land was ploughed and harrowed twice. Cane was planted in May, 1933.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (Mean Square).
Blocks	2	20·76	10·38	..
Nitrogen (N)	1	90·48	90·48	2·2527
Phosphoric Acid (P)	1	2·04	2·04	0·3565
Potash (K)	1	1·40	1·40	0·1681
Errors	18	21·44	1·20	0·0912
Total	23	136·12	..	..

Crop Yields.

	Sulphate of Ammonia.		Superphosphate.		Muriate of Potash.	
	400 lb.	600 lb.	600 lb.	900 lb.	150 lb.	300 lb.
Cane, tons per acre	**44.7**	**48.5**	**46.3**	**46.9**	**46.4**	**46.8**
Cane, percentage of mean yield	95·8	104·2	99·4	100·6	99·6	100·4
C.C.S. in cane, per cent.	**12.0**	**11.8**	**11.9**	**11.9**	**11.8**	**11.9**
C.C.S., tons per acre	**5.36**	**5.72**	**5.50**	**5.57**	**5.51**	**5.56**

Standard Error .. .. **0.68** per cent.

DISCUSSION.

This trial marks a continuation of the project to determine the highest economical applications of nitrogen, phosphoric acid, and potash for South Johnstone alluvial land conditions. Earlier experiments have suggested that the limits lie within the range of the treatments given in the present trial. The following comments may be made, at this stage, on the basis of the results from the plant cane :—

Nitrogen.—In a heavy rainfall year, such as was experienced, plant cane requires added nitrogen, in the form of sulphate of ammonia, despite the fact that a heavy green manure crop had been turned under prior to planting the cane. It would appear, also, that the economic application is in excess of 400 lb. per acre.

Work of the Northern Sugar Experiment Station—continued.

Phosphoric Acid.—For plant cane, following a fallow under green manure cover crop, 600 lb. of superphosphate produced the maximum response to this plant-food.

Potash.—Consistent with previous findings, 150 lb. of potash produced the maximum economic crop even where heavy dressings of sulphate of ammonia and superphosphate were given.

It is not possible to draw definite conclusions at this stage, on the basis of one crop; unfortunately, the trial cannot be concluded successfully owing to the transfer of our activities from South Johnstone to Meringa.

STUBBLE SHAVER EXPERIMENT (THIRD RATOON CROP).

Plan and Yields.

Plots	1	2	3	4	5	6
	Stubble-shaved.	Ordinary Cultivation.	Ordinary Cultivation.	Stubble-shaved.	Ordinary Cultivation.	Stubble-shaved.
	35.4	33.2	34.0	36.2	35.6	39.1

Block.—B4.

Variety.—Badila.

Harvested.—September, 1934.

Age of Crop.—12 months.

Plots.—0·391 acre.

TREATMENTS.

Fertilizer.—All plots received the following amounts of fertilizer :—

600 lb. sulphate of ammonia per acre.
800 lb. superphosphate per acre.
200 lb. muriate of potash per acre.

CULTIVATION.

1. Plots 2, 3, and 5 were ratooned by ploughing away from cane and centres broken with skeleton plough to a depth of 12 inches.

2. Plots 1, 4, and 6 were treated with the Hawaiian Stubble Shaver before ratooning in the above manner.

Crop Yields.

	Ordinary Cultivation.	Stubble-shaved.
Cane, tons per acre	**34.3**	**36.9**
Cane, percentage of mean yield	96·3	103·7
C.C.S. in cane, per cent.	**15.2**	**15.2**
C.C.S., tons per acre	**5.21**	**5.61**

DISCUSSION.

In 1933 a stubble shaving implement was imported from Hawaii for trial purposes. It was thought that the removal of the upper ends of the stubble, after harvest, to a point slightly below the land surface, would result in more effective ratoon growth, and add to the life of the stool. The above trial was therefore set out with a view to determining the influence of the treatment on yield, and to ascertain whether ratooning could be prolonged as a result of the work of this implement.

On this first ratoon crop, the increased yield was 2·6 tons of cane per acre, which shows that the treatment is a profitable one. It is regretted that our vacating the South Johnstone Station necessitates a temporary discontinuance of the experiment. But the appearance of the ratoon growth following the above treatment strongly suggests that the levelling action will lead to a definite prolongation of the life of the stubble, and must be regarded as an essential treatment for the growth of successive ratoon crops on old and heavy lands.

Work of the Northern Sugar Experiment Station—continued.

DETAILS OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE, FROM 1st NOVEMBER, 1932, TO 31st OCTOBER, 1934.

Materials.	Number of Analyses.
Sugar-cane for growers	182
Sugar-cane for Experiment Station	476
Sugar-cane for Experiment Station (Refractometer)	24,280
Sugar-cane fibres	82
Agricultural lime	12
Burnt lime	8
Fertilizers	32
Waters	8
Soils	186
Total	25,266

YIELD OF CANE HARVESTED FROM THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE—SEASON 1934.

	Tons.
Cane sent to mill	494·3
Used for plants, seedling propagation, and analysis	11·8
Total	506·1

Nature of Crop—	Per cent.
Plant cane	34·5
First ratoon	22·1
Second ratoon	10·2
Third ratoon	33·2

Tonnages—	Tons.
Badila plant	28·4
Badila first ratoons	33·6
Badila second ratoon	27·0
Badila third ratoon	146·5
Varieties	258·8
Acreage under cane	13·6
Tons per acre	37·21

CENTRAL SUGAR EXPERIMENT STATION, MACKAY.

Mr. F. Keogh, Chemist in Charge.

METEOROLOGICAL.

Conditions for early planting during March, 1933, were favourable. Good falls of rain in February were followed by dry weather during March, and showery conditions were experienced during April. Later, in the winter and spring, the falls of rain were remarkable in their consistency, and 31 inches were recorded from 1st June to 30th November. These rains were highly beneficial to the early planted cane, but caused much concern to farmers who normally plant during the late winter and spring. Certain growers who planted in July received 19 inches of rain almost immediately, resulting in a poor and weakened strike. The excessive rains also prevented the usual chippings and other cultural operations, so that the cane suffered somewhat from weed growth.

Where transportation of cane from the fields is done by means of wagons, the waterlogged land gave endless trouble, while the soil was badly damaged in the process. As a result, many ratoon blocks failed to make a favourable start, and remained in a backward condition throughout the growing period.

The rains in January, February, and March were below normal, but the falls were well distributed and the cane made fair progress. Similar conditions continued until June, since when dry conditions have persisted. The season generally has been a favourable one, and crops compare very well with the high yields of 1933. As regards the sugar content of the cane, the normal dry conditions of the 1934 winter and spring made for high c.c.s. values, and sugar yields will again approach record proportions.

The following table shows the monthly rainfall distribution for the past five years :—

Month.	1929-30.	1930-31.	1931-32.	1932-33.	1933-34.
September	·02	·28	·31	·76	3·01
October	·56	·62	·94	·28	1·29
November	·90	1·21	5·67	2·02	11·82
December	2·73	2·71	6·17	8·03	5·72
January	28·94	4·12	25·51	7·27	5·01
February	4·38	5·32	2·0	20·92	9·28
March	4·39	5·31	·76	·96	5·30
April	1·14	1·27	2·75	4·40	2·57
May	7·88	1·66	4·52	1·72	3·24
June	3·38	·26	1·15	3·53	2·47
July	·28	·19	·37	9·64	·60
August	·60	·04	·35	1·66	·27
	55·20	22·99	50·50	61·19	50·58

Annual Rainfall since 1920 at the Sugar Experiment Station, Mackay.

Year.	Rainfall in Inches.	Year.	Rainfall in Inches.
1920	57·27	1928	78·28
1921	95·89	1929	64·03
1922	34·47	1930	55·81
1923	25·23	1931	30·01
1924	53·37	1932	48·48
1925	54·80	1933	71·94
1926	34·69	1934 (9 months) ..	29·80
1927	83·87		

Work of the Central Sugar Experiment Station—continued.

Abstract of Meteorological Observations made at Sugar Experiment Station, Mackay, from 1st September, 1933, to 31st August, 1934.

Month.	Rainfall in Inches.	Number of Wet Days.	Average Rainfall, 33 Years, 1901-1933.	Highest Shade Maximum.	Lowest Shade Maximum.	Mean Shade Maximum.	Highest Shade Minimum.	Lowest Shade Minimum.	Mean Shade Minimum.	Lowest Terrestrial Min.	Mean Terrestrial Min.	Mean Diurnal Range.	Mean Temperature, 9 a.m.	Mean Relative Humidity of the Air, at 9 a.m. Saturation equalling 100.
September, 1933	3·01	8	1·78	85·0	68·8	76·7	70·5	44·3	59·8	40·5	57·0	16·9	71·9	80·0
October, 1933..	1·29	4	1·65	85·0	78·0	80·4	69·1	54·8	61·7	52·0	59·1	18·7	76·9	69·0
November, 1933	11·82	11	3·20	94·0	73·2	82·5	74·0	57·0	67·0	54·0	65·4	15·5	77·4	77·0
December, 1933	5·72	16	7·93	92·8	76·7	85·1	74·0	63·0	68·4	59·6	66·4	16·7	80·5	72·0
January, 1934	5·01	18	15·37	96·0	76·9	84·1	76·7	64·6	70·6	62·5	69·3	13·5	79·0	78·0
February, 1934	9·28	10	9·50	94·2	82·0	86·3	77·0	65·2	71·6	62·6	69·8	14·7	81·1	70·0
March, 1934 ..	5·30	16	9·67	86·5	78·0	82·0	74·5	61·0	67·4	57·5	65·1	14·6	76·9	77·0
April, 1934 ..	2·57	12	5·51	87·5	69·7	80·8	73·0	59·2	65·5	56·1	63·9	15·3	75·2	78·0
May, 1934 ..	3·24	12	3·22	82·5	70·0	76·1	67·1	50·0	60·6	46·0	58·8	15·5	69·9	76·0
June, 1934 ..	2·47	9	2·51	80·5	62·0	72·8	62·0	40·0	54·3	37·0	52·0	18·5	65·0	84·0
July, 1934 ..	·60	6	1·52	78·0	67·0	73·0	65·0	42·0	53·5	39·5	51·2	19·5	65·0	78·0
August, 1934 ..	·27	3	1·03	89·0	68·0	74·4	63·0	36·8	48·6	35·0	46·0	25·8	66·6	65·0
Year ..	50·58	125	62·89	..	..	..	..	..	..	..	..	..	..	*75·0

*Average.

Experiments Harvested during 1934.

1. *Trash Trial.*—Plant crop.
2. *Fertilizer Trial.*—Amounts of nitrogen—Second ratoon crop.

New Experiments Initiated.

1. *Cultivation Trial.*—Subsoiling.
2. *Interspacing Trial.*—Early and late applications of nitrogen.
3. *Fertilizer Trial.*—Amounts of nitrogen and phosphate.

Work of the Central Sugar Experiment Station—continued.

TRASH TRIAL (PLANT CROP).

Plan and Yields.

I.	Trash	33.6
	No Trash	40.9
II.	No Trash	38.9
	Trash	41.8
III.	Trash	39.8
	No Trash	37.0

Block.—A1.

Variety.—Q. 813.

Harvested.—September, 1934.

Age of Crop.—15½ months.

System of Replication.—Three randomised blocks.

Plots.—0·167 acre.

TREATMENTS.

Trash Plots.—These plots received trash at the rate of about 20 tons per acre, in the form of compost.

No Trash Plots.—These plots received no trash, but were treated to the equivalent amounts of plant-food employed in preparing the trash compost. These were applied broadcast prior to planting.

PREPARATION OF LAND

After harvesting the old ratoon crop, the land was ploughed, and subsoiled to a depth of from 13 to 15 inches. The trash from the previous crop was turned under in this operation. Poona Pea was sown in November, and when ready to plough under the above trash applications were made to the trash-treated plots. This material was gathered during the previous harvesting season, and formed into a compost heap with the addition of lime and fertilizer. The trash rotted moderately well, though difficulty was experienced in maintaining the pile uniformly moist. The land was planted on the 25th May.

Growth Notes.

A good strike was obtained, and the cane made rapid growth throughout the season. No outstanding growth differences could be detected on the various plots.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (Mean Square).
Blocks	2	9·83	4·92	..
Treatments	1	0·43	0·43	0·7230
Errors	2	34·36	17·18	2·5508
Total	5	44·62	..	..

Crop Yields.

	Trash.	No Trash.
Cane, tons per acre	**38.4**	**38.9**
Cane, percentage of mean yield	99·4	100·6
C.C.S. in cane, per cent.	**14.7**	**14.7**
C.C.S., tons per acre	**5.64**	**5.71**

DISCUSSION.

The yields from both treated and untreated plots are practically identical, showing that no benefits have been experienced to date from the trash treatment. It was not anticipated that outstanding immediate results would be recorded, and the experiment was planned as a long-distance project which would be perpetuated for at least ten years. The trash from the plant cane was conserved by rolling "two rows into one," for the trash plots, while the trash on the control plots was burned after harvest. This policy will be followed for the duration of the trial.

Work of the Central Sugar Experiment Station—continued.

FERTILIZER TRIAL—AMOUNTS OF NITROGEN—(Second Ratoon Crop).

Plan and Yields.

4N 18.6	C 7.8	3N 24.1	1N 16.0	2N 15.1
1N 10.2	2N 16.2	4N 26.4	3N 24.8	C 12.9
2N 11.8	3N 23.0	1N 15.1	C 12.0	4N 27.8
C 8.7	1N 18.3	2N 20.6	4N 26.4	3N 26.2
3N 22.0	4N 22.2	C 16.3	2N 24.8	1N 22.4

Block.—B2.
Variety.—Q. 813.
Harvested.—October, 1934.
Age of Crop.—13 months.
System of Replication.—5 x 5 Latin square.
Plots.—0·05 acre.

TREATMENTS.

All plots received—
400 lb. superphosphate per acre;
150 lb. sulphate of potash per acre.

In addition—

C—No further manure.
1N—125 lb. sulphate of ammonia per acre.
2N—250 lb. sulphate of ammonia per acre.
3N—375 lb. sulphate of ammonia per acre.
4N—500 lb. sulphate of ammonia per acre.

GROWTH AND CULTIVATION NOTES.

After harvesting the first ratoon crop, the trash was raked into alternate rows, the mixed fertilizer was applied, and the clear interspaces were subsoiled to 12 inches deep. The trash was then rolled back on the treated interspace, and the remainder of the field was fertilized and subsoiled.

The first application of sulphate of ammonia was made three weeks later; this included the full dressings for the 1N and 2N plots. The balance of the sulphate of ammonia was applied on the 25th January.

The conservation of trash in the interspaces did not interfere in any way with the usual cultivation, and the cane ratooned well. On the heavier yielding plots, the blanket of trash completely excluded weed growth; on those plots which had a light cover of trash, weeds and grass grew through in places. One chipping along the cane row was, however, sufficient. The trash at harvest time was almost completely rotted.

The crop made good progress throughout the season, where adequate amounts of fertilizer had been applied.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (Mean Square).
Rows	4	82·12	20·53	..
Columns	4	167·58	41·89	..
Treatments	4	584·78	146·20	2·4926
Errors	12	48·07	4·01	0·6944
Total	24	882·55	..	..

Crop Yields.

—	No Nitrogen.	125 lb. Sulphate of Ammonia.	250 lb. Sulphate of Ammonia.	375 lb. Sulphate of Ammonia.	500 lb. Sulphate of Ammonia.
Cane, tons per acre	**11.5**	**16.4**	**17.7**	**24.0**	**24.3**
Cane, percentage of mean yield	61·3	87·3	94·3	127·8	129·4
C.C.S. in cane, per cent.	**16.5**	**16.4**	**16.5**	**16.4**	**16.7**
C.C.S., tons per acre	**1.90**	**2.69**	**2.92**	**3.93**	**4.06**

Standard Error .. .. **4·77** per cent.

Work of the Central Sugar Experiment Station—continued.

Summary of Crop Yields—Plant, First and Second Ratoons.

	Plant Crop.			First Ratoons.			Second Ratoons.		
	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	Per cent.	Tons.	Tons.	Per cent.	Tons.	Tons.	Per cent.	Tons.
No nitrogen	**15.5**	17·8	**2.76**	**21.0**	15·4	**3.23**	**11.5**	16·5	**1.90**
125 lbs. sulphate of ammonia	**15.2**	17·7	**2.69**	**23.5**	15·2	**3.57**	**16.4**	16·4	**2.69**
250 lbs. sulphate of ammonia	**14.9**	17·9	**2.67**	**26.1**	15·1	**3.94**	**17.7**	16·5	**2.92**
375 lbs. sulphate of ammonia	**16.2**	17·5	**2.84**	**28.8**	14·6	**4.20**	**24.0**	16·4	**3.93**
500 lbs. sulphate of ammonia	**17.1**	17·8	**3.04**	**29.5**	14·4	**4.25**	**24.3**	16·7	**4.06**

CONCLUSIONS.

The results of this trial are particularly interesting, and demonstrate very clearly the value of sulphate of ammonia on the old alluvial lands of the Mackay area. While very little benefit was experienced on the plant crop (in an unfavourable year), the crop increases from nitrogen were pronounced with the first ratoons, and the second ratoons which received no sulphate of ammonia were practically a failure. The following are the crop increases recorded for the heaviest dressing of sulphate of ammonia (500 lb. per acre) :—

	Tons Cane per Acre.
Plant crop	1·6
First ratoon crop	8.5
Second ratoon crop	12·8

Despite the heavy application of nitrogenous manure, the c.c.s. values for the second ratoons were not in any way reduced; and the application of 500 lb. per acre of sulphate of ammonia may be taken as a reasonable treatment for ratoons on the deep alluvial soils of this area. Adequate amounts of superphosphate and potash must be made in addition, of course, before the benefits from sulphate of ammonia are fully realised.

Variety Distribution.

The Javan variety P.O.J. 2725 has shown highly promising results both on the Mackay Station and on farm plots established from this centre. The cane appears to be free from certain of the disabilities of the P.O.J. canes hitherto tried in the Mackay area, and it shows definite early maturing characteristics. Propagation plots have therefore been established on the following farms, and from these it is proposed to distribute to desirous growers during the 1935 planting season :—

Lawrie Bros., West Plane Creek.
Garnham Bros., Mount Martin.
W. B. Fordyce, Richmond.
F. Pratt, Calen.
M. O'Neill, Tannalo.
T. McNamara, Tannalo.
C. Latchford, Koumala.
A. Arbuthnot, Homebush.
W. Taylor, Munbura
R. Robinson, Wundaru.
J. V. Connor, Otterburn.
Broomfield Bros., Carmila
Ollett Bros., Habana.
H. Griffiths, Wallingford.
E. Burston, Habana.
C. Hemsworth, Habana.
Young and Young, Walkerston.
H. Ivers, Rosella
G. Davies, Chelona.
P. H. McLean, Pinnacle.
H. Single, Foulden.
Beldan and Sons, North Eton.
G. McDonald, Mia Mia.
P. E. Nielsen, Septimus.
J. Turner, Uruba.

In all, 42 tons of this variety were planted out during the past gsprin.

Work of the Central Sugar Experiment Station—continued.

DETAILS OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE CENTRAL SUGAR EXPERIMENT STATION, MACKAY, FROM 1st NOVEMBER, 1933, TO 31st OCTOBER, 1934.

Sugar-canes for growers	162
Sugar-canes for Station	180
Maturity tests (including reducing sugars)	153
Juice phosphate determinations	75
Waters for irrigation, &c.	20
Soils	18
Seedling work, refractometer brix	500
Canes for Mackay Show	60
Milk samples, Mackay Show	16
Total	1,184

TOTAL TONNAGE OF CANE HARVESTED FROM THE CENTRAL SUGAR EXPERIMENT STATION, MACKAY, SEASON 1934.

	Tons.
Cane sent to mill	159·2
Cane used and sold for plants	4·2
Total	163·4

Nature of Crop—	Per cent.
Plant cane	42·5
First ratoons	14·3
Second ratoons	43·2

Average tons per acre—	Tons.
Plant cane	35·0
First ratoons	22·8
Second ratoons	17·6

Average per acre (entire crop)	25·9 tons
Area harvested	6·32 acres

SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG.

Mr. J. Pringle, Chemist in Charge.

METEOROLOGICAL.

The growing period of 1933–34 was for the most part favourable. Though the soil was rather dry for the March planting, good rains at the beginning of April assured a satisfactory germination. The months of May and June were cool and dry; good progress followed the mid-July rains, but this was checked by dry weather in August and September.

As the result of 5 inches of rain which fell in October, combined with warm, humid conditions, good germinations were obtained from the spring plantings, and the ratoons came away well. The rainfalls during November to February were well distributed, so that rapid progress was maintained; but the unusually cool and cloudy conditions which followed retarded the rate of crop growth, despite satisfactory soil moisture.

April growth was better, and the mild winter conditions assured heavy crops throughout the area. Only a few light frosts were recorded, and these caused no damage to the cane. Most mills in the area report record tonnages, and the present prospects for further heavy tonnages in 1935 are particularly bright.

Rainfall at the Southern Sugar Experiment Station, Bundaberg, during the Growing Season 1933–34.

Month.	Rainfall. Inches.	Number of Wet Days.
August, 1933	1·39	3
September, 1933	0·97	7
October, 1933	6·20	5
November, 1933	6·47	13
December, 1933	10·98	12
January, 1934	2·41	8
February, 1934	21·09	10
March, 1934	2·28	7
April, 1934	11·75	11
May, 1934	1·08	7
June, 1934	2·23	6
July, 1934	1·57	6
August, 1934	1·15	4
September, 1934	0·64	3
October, 1934 (13 days)	1·42	3
Total	71·63	105

Experiments Harvested during 1934.

(1) *Irrigation Trial.*—P.O.J 2878.

(2) *Planting and Cultivation Trial.*—Wide and narrow interspaces, deep and shallow planting, cultivation and no cultivation.

3. *Trash Conservation Trials.*—
   (i.) Trash ploughed under prior to planting.
   (ii.) Relieving v. rolling v. volunteering on ratoons.
4. *Varietal Trials.*—
   (i.) Ratoons of gumming resistant canes.
   (ii.) Plant crop of further new varieties.
5. *Molasses Trial.*—Comparative value of various applications.

New Experiments Initiated.

1. *Irrigation Trial.*
2. *Fertilizer Trial.*—Time of nitrogen application.
3. *Subsoiling Trial.*
4. *Fertilizer Trial.*—Organic v. inorganic manures.

Work of the Southern Sugar Experiment Station—continued.

IRRIGATION TRIAL (Plant Crop).

Block.—Nursery.
Variety.—P.O.J. 2878.
Area.—0·089 acre.
Harvested.—September, 1934.
Age of Crop.—18 months.

TREATMENTS.

The old ratoons were ploughed out and the land worked for immediate planting. The canes were planted, on 2nd March, in deep drills which served as irrigation furrows throughout crop growth. The crop received the following irrigation and fertilizer treatments :—

Irrigation.—

Autumn months	2 inches per week.
Winter months	1 inch per week.
Spring months	3 inches per week.
Summer months	4–5 inches per week.

Fertilizer.—

	Planting Mixture.	Monthly Dressing.
	lbs. per acre.	lbs. per acre.
Sulphate of ammonia	300	100
Superphosphate	200	20
Muriate of potash	400	50
Total	900	170

In all, approximately 1½ tons per acre of artificial manure were applied.

GROWTH NOTES.

The early progress of the crop was excellent, and cane was in evidence by September. Growth measurements, which were made at weekly intervals, showed the rates of crop production which are represented graphically in Fig. 1.

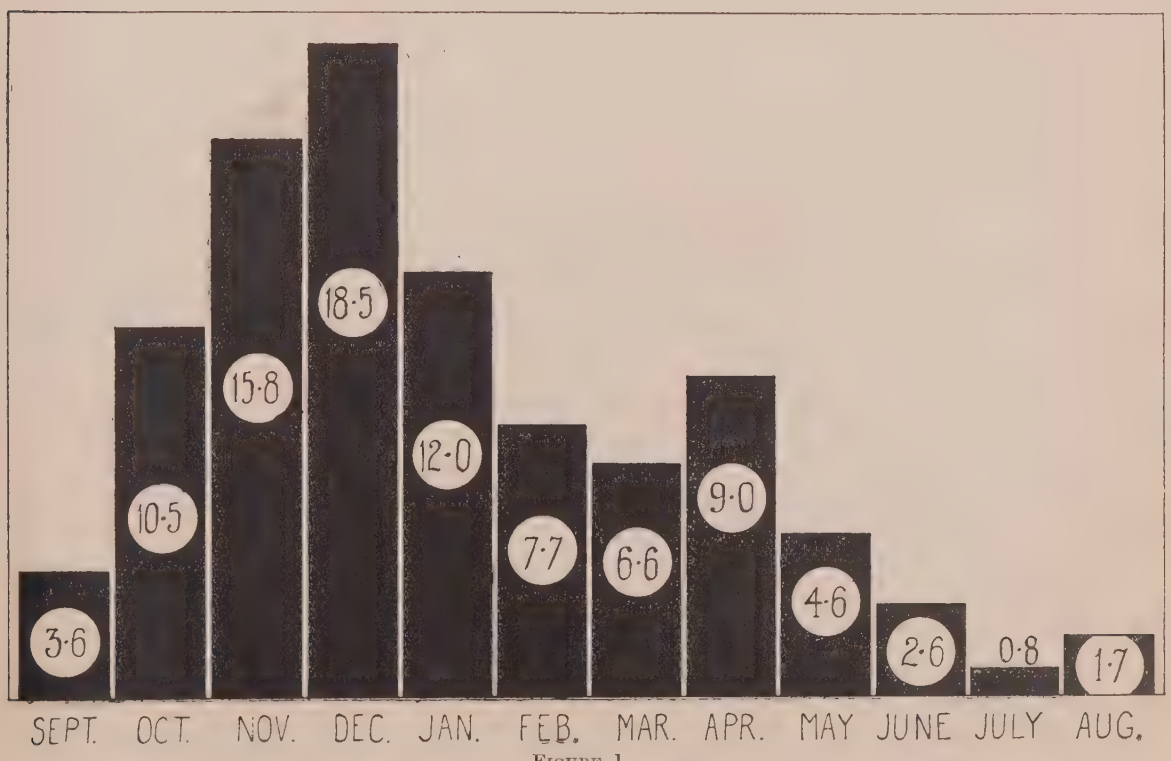

FIGURE 1.

The blocks represent by their height the relative monthly cane production, while the figures give the actual cane tonnage produced in each month.

Work of the Southern Sugar Experiment Station—continued.

The cyclone of early February damaged the crop considerably, and many of the stools were uprooted. The cane made slow recovery from this setback, but reasonable growth was recorded from April to August.

CROP YIELD.

Cane per acre	**93·4** tons
C.C.S. in cane	12·1%
C.C.S. per acre	**11·3** tons.

DISCUSSION.

This experiment marks an attempt to determine the rate of crop production in the Bundaberg area, under optimum conditions of soil moisture and plantfood supply. Unfortunately, the climatic conditions were abnormal—cloudy, cool conditions persisting throughout January, February, and March. Despite this fact and the severe cyclone damage experienced, the crop yield was highly satisfactory, and it must be concluded that the red volcanic soils of the Bundaberg area are capable of producing heavy tonnages of cane provided soil moisture and plantfood supply are adequate.

It should not be necessary to point out that the conditions of irrigation and fertilizer application here employed are not suggested as standard farm practices: the trial was deliberately designed for the specific purpose of maintaining optimum growth conditions in the soil at all times.

Work of the Southern Sugar Experiment Station—continued.

PLANTING AND CULTIVATION TRIAL (Plant Cane).

Interspace Distance—	Plan and Yields.			Fertilizer—
4′ 6″ ..	Shallow Planting	37.1	Cultivated	Double
3′ 9″ ..	Deep Planting	40.0	Non-cultivated	
3′ 9″ ..	Shallow Planting	38.3	Non-cultivated	Single
4′ 6″ ..	Deep Planting	33.0	Cultivated	Double
3′ 9″ ..	Deep Planting	32.6	Cultivated	Single
4′ 6″ ..	Shallow Planting	32.1	Non-cultivated	
4′ 6″ ..	Deep Planting	36.9	Non-cultivated	Double
3′ 9″ ..	Shallow Planting	37.8	Cultivated	Single
4′ 6″ ..	Deep Planting	34.8	Non-cultivated	
3′ 9″ ..	Shallow Planting	43.6	Cultivated	Double
3′ 9″ ..	Deep Planting	35.7	Cultivated	
4′ 6″ ..	Shallow Planting	32.2	Cultivated	Single
4′ 6″ ..	Shallow Planting	35.4	Non-cultivated	Double
3′ 9″ ..	Deep Planting	39.3	Non-cultivated	Single
4′ 6″ ..	Deep Planting	40.1	Cultivated	
3′ 9″ ..	Shallow Planting	44.0	Non-cultivated	Double

Blocks.—E1 and 2.
Variety.—Q. 813.
Harvested.—August, 1934.
Age of Crop.—16½ months.
System of Replication.—Two randomised blocks.
Plots.—0·163 acre.

TREATMENTS.

Planting—
Shallow.—Plants placed 4″-5¼″ below land surface.
Deep.—Plants placed 7¼″-9″ below land surface.

Interspaces—
Narrow.—3′ 9″ between rows.
Wide.—4′ 6″ between rows.

Cultivation—
Cultivated.—Usual procedure with scarifier and hoe.
Non-cultivated.—Hoe only used, at intervals, as weed growth became troublesome.

Fertilizer—
Single Dressing—
150 lb. sulphate of ammonia per acre.
150 lb. superphosphate per acre.
150 lb. muriate of potash per acre.
Double Dressing—
300 lb. sulphate of ammonia per acre.
300 lb. superphosphate per acre.
300 lb. muriate of potash per acre.

GROWTH NOTES.

A good crop of green manure (Poona Pea) was ploughed under, and after a further ploughing and harrowing, the cane was planted in March. The soil was dry at this time, but good rains fell in April, and a satisfactory germination resulted. The crop made good progress, and all plots showed apparently uniform growth throughout the season.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (Mean Square).
Blocks	1	18·71	18·71	..
Interspace	1	55·13	55·13	2·0049
Depth of Planting	1	4·31	4·31	0·7305
Cultivation	1	4·73	4·73	0·7770
Fertilizer	1	21·39	21·39	1·5315
Errors	10	105·99	10·60	1·1804
Total	15	210·26	..	..

Work of the Southern Sugar Experiment Station—continued.

Crop Yields.

	Interspace Distance.		Depth of Planting.		Cultivation.		Fertilizer.	
	3′ 9″	4′ 6″	Shallow.	Deep.	Cult.	Non.	Single.	Double.
Cane, tons per acre	**38.9**	**35.2**	**37.6**	**36.5**	**36.5**	**37.6**	**35.9**	**38.2**
Cane, percentage of mean yield ..	105·0	95·0	101·5	98·5	98·5	101·5	96·9	103·1
C.C.S. in cane, per cent.	**15.1**	**15.2**	**15.2**	**15.1**	**15.1**	**15.2**	**15.4**	**14.9**
C.C.S., tons per acre	**5.87**	**5.35**	**5.71**	**5.51**	**5.51**	**5.71**	**5.53**	**5.69**

Standard Error .. .. **3·11** per cent.

DISCUSSION.

The results of this trial are rather interesting, and the following remarks are offered with respect to the several features of the experiment :—

Interspace Distance.—Previous trials have shown that the planting of certain varieties at less than the standard interspace distance employed in these parts frequently produces superior yields. This has been borne out by the results of the present trial, and the actual gain in crop was 3·7 tons of cane per acre. The influence of the interspace distance on the c.c.s. of the crop was slight. Certainly the past season was favourable for heavy crop production, and it will be interesting to follow the influence of the above modification in a dry year.

Depth of Planting.—The object of this investigation was to determine the influence of the depth of stubble remaining in the ground after harvest on the subsequent ratoon yield. The treatment has had no significant effect on the plant crop.

Cultivation.—On porous soils of the red volcanic type which do not produce heavy weed growth, it is considered that cultivation is of little benefit. Certainly the results of the plant crop in this trial bear out the contention.

Fertilizer.—Apparently the double application of manure has resulted in a slight increase in crop yield on the plant cane (2·3 tons). The extra nitrogen added in this way, following a green manure crop prior to planting, has produced a substantial reduction in the c.c.s. value of the cane; it is probable that the increased yield is largely the result of the double dressing of potash.

Work of the Southern Sugar Experiment Station—continued.

TRASH CONSERVATION TRIAL (Plant Cane).

Plan and Yields.

No Trash	34.8
Trash	33.8
Trash	38.6
No Trash	37.6

Block.—E3A.

Variety.—Q. 813.

Harvested.—September, 1934.

Age of Crop.—17½ months.

Plots.—0·293 acre.

TREATMENTS.

The trash and tops from the previous ratoons were spread over the two trash plots before the old stools were ploughed out. In addition, the trash plots were treated with a compost formed by rotting the stunted and frost-affected cane from another block: a compost heap was built up with about 5 tons of this material, with additions of plantfood to hasten the rotting process. In January, 1933, this material was turned into the trash plots and the cane planted in March. The "no trash" plots received an addition of fertilizer equivalent to that employed in preparing the compost pile.

GROWTH NOTES.

The germination of the cane on the "no trash" plots was very good, but quite a number of supplies were necessary on the trash plot; this was due to the incompleteness of the trash decomposition when the land was planted. It was several months before this cane made up the leeway caused by the unfavourable conditions, but thereafter all plots produced very satisfactory crops.

Crop Yields.

	Trash.	No Trash.
Cane, tons per acre	36·2	36·2
C.C.S. in cane, per cent.	16·1	15·7
C.C.S., tons per acre	5·83	5·68

DISCUSSION.

The area occupied by this trial has been set aside for permanent trash plots, and it is intended that the above treatments will be continued over a series of years. The plant crop yields were identical, so that no benefits are as yet apparent. The trash from the plant cane was burned on the "no trash" plots, and rolled into alternate interspaces on the trash plots. The trash will be conserved in this manner until the block is ploughed out, when the trash residues will be turned under and the entire area devoted to a green manure crop.

Work of the Southern Sugar Experiment Station—continued.

TRASH TRIAL—RELIEVING v. VOLUNTEERING v. ROLLING (First Ratoon Crop).

Plan and Yields.

Volunteered. 23.0	Relieved. 24.9
Rolled 22.4	Trash Burnt 21.8
Relieved 21.7	Volunteered 18.3
Trash Burnt 25.2	Rolled 18.0
Volunteered 22.9	Relieved 20.6
Rolled 24.1	Trash Burnt 18.0

Block.—C1.

Variety.—Q. 813.

Harvested.—September, 1934.

Age of Crop.—12 months.

System of Replication.—Three randomised blocks.

Plots.—0·1363 acre.

TREATMENTS.

Volunteered.—Trash from plant cane allowed to remain *in situ*.

Relieved.—Trash drawn away from the stools in each row.

Rolled.—Trash rolled into alternate interspaces, and the bared interspace ratooned with the subsoiler; trash then rolled back to the cultivated space, and the balance of the plot ratooned similarly.

Trash Burnt.—Trash burnt in the usual manner.

The block had been treated with molasses when previously in fallow, and no further fertilizer treatment was given in the ratoons.

GROWTH NOTES.

The ratoons germinated well in all plots, and made steady growth until checked by cool, wet conditions in April. At no time was there any apparent differences due to the respective treatments.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Blocks	2	10·12	5·06	..
Treatments	3	1.91	0·64	0·9281
Errors	6	53·91	8·99	2·2495
Total	11	65·94	..	..

Crop Yields.

—	Volunteered.	Relieved.	Rolled.	Trash Burnt.
Cane, tons per acre	21.4	22.4	21.5	22.0
C.C.S. in cane, per cent.	16·2	16·1	15·8	15 7
C.C.S., tons per acre	3.46	3.60	3.40	3.45

DISCUSSION.

The treatments under review in this trial are those commonly employed in dealing with trash. The results of the experiment do not reveal any significant superiority of one method over the others. Certainly the year was one when climatic conditions did not favour the trash conservation scheme in that the mulching value of the crop residues did not operate as an important factor.

The trial will be continued through the second ratoons, and it is hoped that a variation in conditions may be experienced to throw some light on the value of the respective methods of handling this important material.

Work of the Southern Sugar Experiment Station—continued.

VARIETAL TRIAL (First Ratoon Crop).

Plan and Crop Yields.

POJ 2725 55.9	Q 813 20.3	POJ 234 34.5	Q 813 20.6	Co 290 49.1
Q 813 22.9	Co 290 54.4	Co 281 33.0	Manoa 304 18.0	Q 813 22.9
POJ 234 39.8	POJ 2725 43.9	Q 813 21.0	Co 290 42.4	POJ 2725 34.9
Co 290 51.8	Q 813 18.0	Manoa 304 17.3	Q 813 18.8	POJ 234 27.0
Q 813 21.0	POJ 234 31.9	Co 290 49.1	26 C 188 24.4	Q 813 18.0
26 C 188 25.9	Manoa 304 18.0	Q 813 21.4	POJ 234 24.8	Co 290 *
Co 290 *	Q 813 21.0	POJ 2725 57.8	Q 813 19.1	Co 281 34.9

* Not harvested—cane reserved for plants.

Block.—B1.

Harvested.—October, 1934.

Age of Crop.—12-14 months.

Plots.—1/30 acre.

CULTIVATION.

When all plots had been harvested in 1933, the ratooning of the block was carried out in the usual manner. Mixed fertilizer was applied uniformly at the following rate per acre :—

150 lb. sulphate of ammonia.
150 lb. superphosphate.
250 lb. muriate of potash.

One month later, all plots were top dressed with sulphate of ammonia at the rate of 150 lb. per acre.

GROWTH NOTES.

The plots showed uneven development at ratooning time, due to the irregular plan which had necessarily to be followed in harvesting the plant crop. All made good progress while favourable conditions prevailed, but Q. 813 and Manoa 304 fell away most rapidly when dry conditions were experienced. P.O.J. 2725 commenced to arrow early in May, and had shot badly at the uppermost eyes when harvested. P.O.J. 234 also arrowed slightly in June.

Crop Yields.

Variety.	No. of Plots.	Cane, tons per acre.	C.C.S. in Cane, per cent.	C.C.S., tons per acre.
Co. 290	5	49.4	15·1	7.46
P.O.J. 2725	4	48.1	17·2	8.28
Co. 281	2	34.0	14·4	4.90
P.O.J. 234	5	31.6	15·9	5.02
26 C. 188	2	25.2	14·6	3.68
Q. 813	12	20.4	16·2	3.30
Manoa 304	3	17.8	14·1	2.51

Work of the Southern Sugar Experiment Station—continued.

Summary of Crop Yields, Plant and First Ratoon Crops.

Variety.	Plant Cane.			First Ratoons.		
	Cane, tons per acre.	C.C.S. in cane, per cent.	C.C.S., tons per acre.	Cane, tons per acre.	C.C.S. in cane, per cent.	C.C.S., tons per acre.
Co. 290	**22.8**	..	..	**49.4**	15·1	**7.46**
P.O.J. 2725	**16.8**	..	..	**48.1**	17·2	**8.28**
Co. 281	**15.1**	..	..	**34.0**	14·4	**4.90**
P.O.J. 234	**13.8**	..	..	**31.6**	15·9	**5.02**
26 C. 188	**12.2**	..	..	**25.2**	14·6	**3.68**
Q. 813	**9.3**	..	..	**20.4**	16·2	**3.30**
Manoa 304	**9.2**	..	..	**17.8**	14·1	**2.51**

DISCUSSION.

The plant crop was grown under most adverse conditions, yet certain of these new, gum-resistant varieties were able to produce reasonable crops where the standard (Q. 813) was practically a failure.

With favourable conditions for the first ratoon crop, the new canes exhibited phenomenal growth. It is interesting to note, also, that the yields follow precisely the same order as was recorded for the plant cane. Co. 290 again headed the list for tons of cane per acre, with a yield of almost 50 tons. This was closely followed by P.O.J. 2725, with an average of 48 tons per acre. With respect to the c.c.s. in cane, the P.O.J. 2725 outstripped all other varieties, and at harvest time gave 17·2%. It therefore produced the heaviest tonnage of c.c.s. per acre—8·28 tons.

Of the remaining varieties, P.O.J. 234 shows greatest promise, by virtue of its early-maturing characteristics, though it is rather susceptible to mosaic disease.

The results of the present crop support the earlier claims which were advanced for these canes, and all three (P.O.J. 2725, Co. 290 and P.O.J. 234) have been planted out in a number of farm propagation plots from which they will be freely distributed next spring.

Work of the Southern Sugar Experiment Station—continued.

VARIETAL TRIAL (Plant Crop).

Plan and Crop Yields.

POJ 2722 23.6	Q 813 22.1	26 C 148 25.9	Q 813 21.8	POJ 2722 26.6
POJ 2727 25.5	POJ 213 27.0	Q 813 21.0	26 C 99 19.1	U.D. 1 24.4
Q 813 21.8	POJ 2940 27.0	U.H. 1 22.5	POJ 2722 21.4	Q 813 20.6
POJ 2722 31.9	POJ 2747 *	Q 813 22.9	POJ 213 26.6	U.D. 1 25.1
POJ 2940 22.9	Q 813 22.5	POJ 2727 27.4	Q 813 17.3	POJ 2940 21.0
Q 813 22.9	POJ 2727 24.0	U.D. 39 22.5	POJ 2722 20.3	Q 813 21.0
POJ 2727 25.5	U.D. 1 28.9	Q 813 20.3	POJ 213 21.4	POJ 2940 21.0
POJ 213 27.4	Q 813 20.6	POJ 2722 19.1	Q 813 19.5	26 C 270 19.1

*Discarded due to disease.

Block.—B3.

Harvested.—October, 1934.

Age of Crop.—14 months.

Plots.—1/30 acre.

CULTIVATION.

A heavy crop of Poona pea was turned under while the land was in fallow. This was carried out in March, following which the land was twice cross-ploughed and harrowed. The canes were planted in August, and the following fertilizer mixture was applied as a drill application :—

150 lb. superphosphate.
200 lb. muriate of potash.

No further manure was applied.

GROWTH NOTES.

The soil was in excellent condition at planting time ; Q. 813, P.O.J. 2727, and P.O.J. 213 gave good germinations, those from 26 C. 148, U.D. 1, 26 C. 270, and U.D. 39 were fairly good, while U.H. 1, P.O J 2722, and P.O.J. 2940 gave poor results. The cane made good progress until checked by cool conditions in April. P.O.J. 2940 and 2722 arrowed early in June. The former made the most rapid growth of all canes, and at harvest time some of the sticks showed 11 feet of cane.

Crop Yields.

Variety.	No. of Plots.	Cane, tons per acre.	C.C.S. in cane, per cent.	C.C.S., tons per acre.
U.D. 1	3	**26.1**	15·9	**4.15**
26 C. 148	1	**25.9**	15·7	**4.07**
P.O.J. 2727	5	**25.8**	16·2	**4.18**
P.O.J. 213	4	**25.6**	15·4	**3.94**
P.O.J. 2722	5	**23.3**	16·0	**3.73**
P.O.J. 2940	4	**23.0**	17·6	**4.05**
U.H. 1	1	**22.5**	17·6	**3.96**
U.D. 39	1	**22.5**	15·7	**3.53**
Q. 813	13	**21.1**	16·8	**3.55**
26 C. 99	1	**19.1**	12.8	**2.44**
26 C. 270	1	**19.1**	14·2	**2.71**

DISCUSSION.

This preliminary trial marks an attempt to determine the commercial value of the second series of varieties, which have been released after satisfying the requirements of gumming resistance trials. The outstanding cane of the series appears to be P.O.J. 2727, which produced the highest yield of c.c.s. per acre. P.O.J. 2940 showed a remarkably high c.c.s. content, but the tonnage yield was influenced by the indifference of the strike. Further comment will be deferred until the ratoon crop has been harvested.

Work of the Southern Sugar Experiment Station—continued.

MOLASSES TRIAL (First Ratoon Crop).

Plan and Crop Yields.

8 tons molasses per acre.	6 tons molasses per acre.	4 tons molasses per acre.
24.6	23.7	20.9

Block.—A1.
Variety.—Q. 813.
Harvested.—October, 1934.
Age of Crop.—12 months.
Plots.—0·725 acre.

CULTIVATION.

On removal of the plant crop in October, the cane was ratooned with the subsoiler. No molasses or fertilizer was applied on the ratoons, and the yield differences are due to residual effects of the molasses applied prior to the plant crop.

GROWTH NOTES.

The ratoons started well and grew vigorously until affected by dry conditions in January. Good progress followed the February rains, but cool, wet conditions in April retarded the growth, but the cane continued to grow slowly until harvested.

Crop Yields.

	Molasses (per Acre).		
	4 Tons.	6 Tons.	8 Tons.
Cane, tons per acre	**20.9**	**23.7**	**24.6**
C.C.S. in cane, per cent.	16·3	16·2	16·6
C.C.S., tons per acre	**3.40**	**3.84**	**4.08**

Summary of Crop Yields, Plant and First Ratoons.

	Plant Cane.			First Ratoons.		
	4 Tons.	6 Tons.	8 Tons.	4 Tons.	6 Tons.	8 Tons.
Cane, tons per acre ..	**12.8**	**13.4**	**13.3**	**20.9**	**23.7**	**24.6**
C.C.S. in cane, per cent. ..	15·4	15·2	15·5	16·3	16·2	16·6
C.C.S., tons per acre ..	**1.97**	**2.04**	**2.07**	**3.40**	**3.84**	**4.08**

DISCUSSION.

With the prevalence of more favourable growing conditions, the yields from the first ratoon crop far outyielded those of the plant cane. The increased yield due to progressively heavier applications of molasses was also quite marked in the ratoons, and on the red volcanic soil it would appear that from 6 to 8 tons of molasses per acre will provide a satisfactory dressing.

Work of the Southern Sugar Experiment Station—continued.

DETAILS OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, FROM 1st NOVEMBER, 1933, TO 31st OCTOBER, 1934.

Materials.	Number of Analyses.
Sugar-canes and juices for growers	656
Sugar-canes and juices for Agricultural Show, Bundaberg ..	237
Sugar-canes and juices for Agricultural Show, Maryborough ..	47
Sugar-canes and juices for Agricultural Show, Gin Gin	312
Sugar-canes and juices for Experiment Station	110
Total	1,362

In addition to the above, field Refractometer tests were made of upwards of 4,000 seedlings in August and September.

TOTAL TONNAGE OF CANE HARVESTED FROM THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, DURING 1934.

	Tons.
Cane sent to mill	474·3
Cane used for plants	2·7
Total	477·3

Nature of Crop—

	Tons.
Autumn plant cane	184·2
Spring plant cane	70·8
First ratoon cane	212·9
First ratoon (standover)	9·4

Tonnages—

	Per cent.
Q. 813	80·9
Other varieties	12·2
Seedling canes	6·9

Area harvested	18 acres
Average tons per acre	26·52

Report of the Division of Entomology and Pathology.

Mr. Arthur F. Bell, Officer in Charge.

In order to achieve more effective co-operation in the considerable amount of closely related investigation, and in the interests of centralised executive control, the two Divisions of Entomology and Pathology were merged into one during the year. Mr. Edmund Jarvis has taken up duties at Head Office, while Mr. R. W. Mungomery has been transferred from Bundaberg to Meringa. On the pathological side, Mr. C. G. Hughes joined the staff in January, while Mr. W. Cottrell-Dormer resigned in July last in order to accept an outside position; the vacancy caused by Mr. Dormer's resignation has not yet been filled.

An event of the greatest practical importance has been an amendment of the Sugar Cane Prices Act which requires that there shall be published each year, in each mill district, a list of cane varieties which are designated "approved varieties," and that all varieties not being approved varieties shall be crushed only upon payment of a penalty not exceeding ten shillings per ton of cane. Lists are issued in the first instance by the Bureau of Sugar Experiment Stations and furnished to the Local Cane Prices Board in each mill district; each Board is then required to designate any or all varieties in such list to be approved varieties but may not designate as approved any variety which is not included in the lists as issued. By virtue of this enactment it is hoped gradually to eliminate disease-susceptible varieties as they are superseded by disease-resistant varieties of equal or higher yielding power. The effect of this will be to remove dangerous sources of infection and pave the way for the successful propagation of high-yielding but disease-susceptible varieties at a later date. The limitation of varieties will also aid very materially in reducing the incentive to remove varieties from one district to another, and hence minimise the risks of spreading the various diseases into new localities.

The first lists were issued during the current year when, as a preliminary step, an effort was made to eliminate those numerous miscellaneous varieties which are grown to a very small extent in all districts.

Attention has again been focussed on the large-scale testing of the resistance of varieties to disease, and over one thousand varieties were observed in trials involving resistance to gumming, leaf-scald, red stripe, downy mildew, "red spot," Fiji and dwarf diseases. Highly significant results have been obtained from field trials designed to determine the magnitude of the losses due to chlorotic streak disease in the variety Badila in North Queensland. From trial results recorded elsewhere in this report it is apparent that a loss of something of the order of 30 per cent. may be expected as a result of the planting of diseased Badila. This disease is very widely distributed in the low-lying wetter areas of the districts north of Cardwell and, with the control of gumming disease in Southern Queensland in sight, it must be considered as the most important cane disease in the State. There are numerous large stretches of canefields where the infection is 75-100 per cent. and the aggregate losses due to the disease must be very large. The situation is one which well merits the co-operative attention of growers in each district with a view to the provision of disease-free planting material.

Following the reorganisation of the Division, particular attention is being paid to the two chief entomological problems—viz., control of the grub of the greyback cockchafer (*Lepidoderma albohirtum*) and the weevil borer (*Rhabdocnemis obscurus*). As far as is practicable work at the Northern station at Meringa will be concentrated upon these two pests exclusively. A comprehensive programme of work has been planned for the next few years and it is confidently expected that more economic and efficient methods of control will be evolved in the reasonably near future. The wireworm investigations in the Central district canefields have been brought to a successful conclusion, and methods for the control of this pest can now be advocated with full confidence.

Variety Introductions.

No varieties were introduced from abroad during the year due to lack of sufficient quarantine facilities. However, a new insect-proof quarantine greenhouse is now nearing completion and will permit of increased importations of foreign cane varieties.

Chlorotic Streak Disease.

In my last annual report attention was directed to the great reduction in yield resulting from a trial planting of chlorotic streak diseased cuttings of Badila when compared with healthy cuttings of similar weight. It was further pointed out, however, that this

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was a very small trial conducted in a latitude where Badila is normally a two-year crop, and hence similar results would not necessarily be expected in the northern latitudes where the disease was prevalent. In order to determine the magnitude of the losses likely to be incurred in the wet tropical belt two field trials were set out, one involving the testing of diseased *versus* healthy (Tableland Nursery) cane, and the other untreated diseased cane *versus* warm water treated diseased cane. Details of these trials and the results obtained are set out below :—

LOSSES DUE TO PLANTING OF CHLOROTIC STREAK DISEASE.

Experiment (a).

Plan and Yields.

Diseased (2) 27.66	**Healthy (4)** 38.23
Healthy (2) 31.95	**Diseased (4)** 28.78
Healthy (1) 32.40	**Diseased (3)** 30.79
Diseased (1) 24.27	**Healthy (3)** 33.22

Location.—Walker Estates, Meerawa, Gordonvale.

Planted.—3rd July, 1933.

Harvested.—6th August, 1934.

Experimental Layout.—Four randomised blocks.

Plots.—·025 acre.

Variety.—Badila.

Source of Planting Material.—Healthy cane was obtained from the Tableland Nursery at Malanda. Diseased material was taken partly from marked stools in an adjoining block and partly from a grab sample. This procedure was rendered necessary owing to the crop generally, and the marked diseased stools in particular, failing to yield expected returns. As a result, the distribution of disease in the plots was not uniform.

Crop Notes.—The healthy cane germinated the more rapidly and gave 95-100 per cent. germination as compared with 91 per cent. for the diseased. Healthy plots were always markedly ahead of diseased plots and at no time was the presence of any disease noticed in the former. Based on a count made in late October (a favourable period) the average number of diseased stools in the diseased plots was 70 per cent., the greatest amount being in diseased plot No. 2 and the least in plot No. 3.

Analysis of Results.—Student's Method for the interpretation of paired experiments was considered to be the most suitable method for the analysis of the results of this experiment :—

Plot No.	Healthy Plots.	Diseased Plots.	Gain H—D.	Deviation from Mean.	Square of Deviation.
1	32·40	24·27	8·13	2·05	4·20
2	31·95	27·66	4·29	—1·79	3·20
3	33·22	30·79	2·43	—3·65	13·32
4	38·23	28·78	9·45	3·37	11·36
		Sum—	24·30	..	32·08
		Mean (N=4)—	6·08	..	8·02

$$\text{Standard Deviation} = \sqrt{8{\cdot}02} = 2.83; \quad Z = \frac{6.08}{2.83} = 2.15$$

Consequently the odds are approximately 60 : 1 that the difference in yield is not due to chance.

Summary of Yields.

Average of four healthy plots	**33.95** tons per acre
Average of four diseased plots	**27.87** tons per acre
Mean loss	**6.08** tons per acre or **17.9** per cent.

Division of Entomology and Pathology—continued.

Experiment (b).

Plan and Yields.

Healthy Untreated (1) 34.23	**Healthy Untreated (2)** 29.75
Diseased Untreated (1) 22.91	**Diseased Treated (2)** 28.20
Diseased Treated (1) 32.66	**Diseased Untreated (2)** 18.50

Location.—A. M. Cousins' farm, Feluga, Tully.

Planted.—22nd July, 1933.

Harvested.—3-4 October, 1934.

Experimental Layout.—Two blocks of paired plots of treated and untreated cane. Two plots of adjoining healthy untreated cane were later measured off and added to the trial.

Plots.—·025 acre.

Variety.—Badila.

Treatment.—80-90 per cent. of the setts of diseased cane were taken from stalks which actually bore leaf symptoms, the remainder being taken from stools in which other stalks bore leaf symptoms. One-half the setts were treated in warm water for 20 minutes at 52° Centigrade after a pre-heating period of 5 minutes. Plants were treated in bags (half a bag at a time) and hence circulation between setts was not the best possible, but simulated that obtainable under practical conditions. This treatment and the subsequent planting of the trial were kindly carried out by Mr. H. G. Knust.

Crop Notes.—The treated cane germinated much more rapidly than the untreated; four weeks after planting the germination of the former was approximately 100 per cent., while that of the latter was only 1 per cent. Subsequently, however, about 93 per cent. germination was obtained in the untreated plots. Approximately 100 per cent. of the stools in the diseased untreated plots exhibited symptoms of chlorotic streak, while only 8 stools (2·5 per cent.) of the treated stools exhibited such symptoms throughout the life of the crop. Stooling in the diseased plots was noticeably more sparse and there was considerable binding of trash.

Results.—The experimental layout was determined by the amount of known diseased cane available and facilities for the warm water treatment thereof; as a result the plots could be planted in duplicate only. Consequently mathematical analysis of the results was not practicable. Owing to the rapid germination of the treated cane it appeared that warm water treatment *per se* might produce an increased yield. In order to check this possibility to some extent two further plots of 1/40 acre were marked out in the adjoining cane which had been planted at the same time with healthy cane selected by Mr. Cousins.

Summary of Yields.

—	Healthy Untreated.	Diseased Treated.	Diseased Untreated.
	Tons.	Tons.	Tons.
Plot 1	34.23	32.66	22.91
Plot 2	29.75	28.20	18.50
Average	31.99	30.43	20.71

The following comparisons are of interest:—

(*a*) Healthy untreated No. 1—Treated No. 1 = 1·57 tons
Healthy untreated No. 2—Treated No. 2 = 1·55 tons } Average 1·56 tons.

(*b*) Treated No. 1—Untreated No. 1 = 9·75 tons
Treated No. 2—Untreated No. 2 = 9·69 tons } Average 9·72 tons.

Discussion.

It has been shown that the difference of 6·08 tons between the yield of the healthy and diseased plots in the Meerawa trial is significant, and it may, therefore, be accepted that the difference of 9·72 tons per acre in the Feluga trial is also significant. Furthermore, the slightly increased (though doubtless not significant) yield of healthy untreated plots over the diseased treated plots indicates that this difference in yield is due to the effects of the disease and not to warm water treatment purely as such. It has been recorded above that the average infection of the diseased plots in the Meerawa

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trial was 70 per cent. For the purposes of comparison, therefore, we might perhaps legitimately assume that if the cane had been 100 per cent. diseased, the loss would have been not 6·08 tons but 8.7 tons, and the results of the two trials as follows :—

Losses due to Chlorotic Streak Disease in Badila.

Meerawa Trial : loss = **8.70** tons per acre or **25.6** per cent.
Feluga Trial : loss = **9.72** tons per acre or **30.4** per cent.

It would therefore appear that under the conditions of North Queensland the planting of chlorotic streak diseased Badila must be expected to result in a loss of crop of the order of 25 per cent. in the plant crop, and an as yet undetermined loss in the ratoons. Since Badila constitutes approximately 90 per cent. of the crop in the areas north of Cardwell, these results obviously provide much food for thought.

Observations have tended to confirm the opinion that the disease is of most consequence and spreads most rapidly in the low-lying country in the heavy rainfall zone. In order to determine the localities and rate of greatest spread fourteen plantings of plots of disease-free cane have been made as follows :—

Hambledon :	Alluvial soil.
Mulgrave :	Alluvial, and acid alluvial.
Babinda :	Volcanic, alluvial (3), and gravel.
Goondi :	Volcanic, rich alluvial and alluvial.
Tully :	Gravelly loam, alluvial, and gravelly loam.

Although the efficacy of plant selection or treatment has been demonstrated for the plant crop under the conditions of the two experiments cited above, its complete possibilities or limitations will not be known until observations on these plots have been concluded. Attempts to transmit the disease by mechanical means have so far proved unsuccessful. It is hoped that differential rates of infection of the above plots will give useful information as a basis for the investigation of possible insect transmission. So far, pressure of other work has not permitted this being undertaken seriously.

No reliable observations regarding varietal resistance have yet been recorded, but the disease has been observed in practically all the varieties grown commercially in the far north, including Badila, S.J. 4, Clark's Seedling, H.Q. 409, Korpi, and D. 1135.

Gumming Disease.

An intense and prolonged wet season greatly favoured the spread of gumming disease and in the districts where the disease is prevalent leaf symptoms were apparent in virtually every stool of susceptible varieties. In the Bundaberg-Isis area the mild winter and excellent growing conditions prevented the effects of the disease from being as severe as they would otherwise have been ; in the Maroochy district, however, the excessively wet conditions throughout the season have intensified the effects.

Suitable weather conditions and the growing of susceptible varieties have been responsible for the occurrence of dormant outbreaks of the disease in the Farleigh and Mulgrave areas. In the Farleigh area the disease has appeared in the variety P.O.J. 2714 in the localities where the disease was last seen in 1927-8. These farms abut on to abandoned cane lands in the foothills whence infection has probably come. Fortunately these farm areas are rather scattered, which aids in preventing rapid spreading of the disease from farm to farm.

The outbreak in the Mulgrave area is more serious owing to the extreme susceptibility of the seedling S.J. 4, a variety which otherwise promises to be particularly suitable for the poorer class of soils in this district. The outbreak has occurred in the triangle between Behana Creek and the Mulgrave River. It will be recalled that a previous outbreak occurred in this area in 1924, but was brought under control by the planting of resistant varieties. However, susceptible varieties were not completely eliminated, and the disease has apparently persisted in a tolerant variety (assuming there has been no untraced reintroduction of cane from an outside diseased area). During the course of the past five years many hundreds of varieties have been tested for resistance to gumming disease, but it can be stated that S.J. 4 is the most susceptible cane with which we have had experience. At present the complete extent of the outbreak is unknown, and farm surveys are still in progress.

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In the Southern districts the situation is well in hand, and next season will see large-scale plantings of highly resistant and otherwise desirable varieties and permit the rapid elimination of the old susceptible standards. As a result of this year's trials the varieties Co. 290 and P.O.J. 2725, and to a less extent P.O.J. 234, appear to be of outstanding value. The highly resistant variety P.O.J. 2878 appears to have particular merit as a standover cane, and some excellent yields have been recorded during the current season. In view of the excessive rainfall during the 1933-34 season on the Maroochy River, and the fact that the cane was completely lodged, the excellent yield obtained by Messrs. English and Wells, Maroochy River, is of particular interest. This plot, 2·6 acres in extent, was established by the Bureau as a seed plot in 1932. Owing to the poor demand for plants of P.O.J. 2878 in this district in the spring of 1933, the block was allowed to stand over, and was harvested this year at the age of 24½ months, when 212 tons of cane were cut for a c.c.s. (average of 19 tests at Moreton Mill) of 14·6 per cent. Converting this into terms of 94 net titre sugar, it will be seen that the yield was at the rate of 6·2 tons of sugar per acre per twelve-month period.

RESISTANCE TRIALS.

Three series of resistance trials were conducted at Childers (varietal, mainly New Guinea canes of the Brandes collection), Bundaberg (varietal), and Moreton (varietal and family). The trials were planted out on the standard plan of making every third row a mixture of three or more susceptible varieties inoculated with at least six strains in order to avoid possible misleading effects of strains of varying pathogenicity.

(a) Family Resistance Trial.

Location: D. McDonald's farm, Bli Bli, Nambour.

Planted: 1st September, 1933.

Plan: Every third row mixed M. 189, N.G. 125, E.K 28 and McB. 6. Two setts of each seedling planted. Guard rows inoculated with a mixture of six cultures.

Results of latter two inspections, calculated as percentages :—

Cross.	Total Stools.	Inspection 10th July, 1934.			Inspection 17th October, 1934.		
		Few or no leaf streaks.	Numerous leaf streaks.	Stools with dead canes.	Few or no leaf streaks.	Numerous leaf streaks.	Stools with dead canes.
		%	%	%	%	%	%
P.O.J 2875 × H.Q. 409 ..	117	80	17	3	65	2	33
P.O.J 2878 × H.Q. 409	73	61	34	5	52	14	34
N.G. 16 × H.Q. 409	46	19	72	9	26	15	59
N.G. 16 × Q. 813	89	36	58	6	36	20	44
N.G. 16 × W. 4	126	49	47	4	43	5	52
N.G. 16 × Ewa 371	58	45	38	17	29	7	64
N.G. 24 × Ewa 371	27	15	44	41	12	7	81
Rose Bamboo × S.C. 12/4 ..	95	0	35	65	3	1	96
Black Cheribon × S.C. 12/4 ..	75	30	53	17	29	7	64
Co. 290 × S.C. 12/4	40	100	0	0	90	0	10
N.G. 15 × S.C. 12/4	63	16	67	17	27	14	59
N.G. 15 × N.G. 24	86	17	56	27	17	17	66
Pompey × D. 1135	107	8	77	15	6	4	90
Pompey × S.J. 4	33	0	58	42	0	9	91

Discussion of Results.

As will be seen by reference to (*b*) gumming disease was particularly severe in this trial, as evidenced by the fact that an appreciable amount of death occurred in the standard cane Q. 813. Results must, therefore, be interpreted accordingly, and the results of the July inspection are included for comparison; at the time of this inspection no death had occurred in the variety Q. 813 On the basis of the recorded results of these two inspections, and having regard for the limitations imposed by small numbers, it would seem that the crosses might be graded as follows, insofar as resistance to gumming disease is concerned :—

Desirable.	Doubtful.	Discard.
Co. 290 × S.C. 12/4	N.G. 16 × Q. 813	Rose Bamboo × S.C. 12/4
P.O.J. 2875 × H.Q. 409	N.G. 16 × W. 4	Pompey × S.J. 4
P.O.J. 2878 × H.Q. 409	N.G. 16 × H.Q. 409	Pompey × D. 1135
		N.G. 24 × Ewa 371
		N.G. 16 × Ewa 371
		N.G. 15 × N.G. 24
		N.G. 15 × S.C. 12/4
		Black Cheribon × S.C. 12/4

Division of Entomology and Pathology—continued.

(b) Varietal Resistance Trials.

Location : Bundaberg, Childers, and Nambour.

Plan : 10–15 setts each variety planted with every third row a guard row of mixed M. 189, M. 1900 S., and D. 1135 (Childers and Bundaberg), or M. 189, N.G. 125, E.K. 28, and McB. 6 (Nambour).

Planted : 18th August-19th September, 1934. Germinations good.

Results of final inspections made 8–17 October, 1934 :—

Location of Trial.	Variety.	Comparative Vigour.	Amount of Death.	Living Stalks oozed Gum.
D. McDonald's farm, Bli Bli, Nambour	N.G. 125	Fair	++	..
	E.K. 28	Poor	+++	..
	M. 189	Poor	++	..
	McB. 6	Bad	+++	..
	Q. 813	Fair	+	9/65
	Q. 822	Bad	+++	..
	Q. 855	Bad	+++	..
	Q. 1098	Good	+	23/36
	"A" 42	Poor	+++	..
	"A" 43	Fair	+++	..
	"A" 52	Poor	+++	..
	H. 5909	Good	++	..
	Manoa 213	Poor	+++	..
	P.O.J. 100	Fair	++	7/20
	P.O.J. 2714	Fair	++	12/24
	P.O.J. 2722	V. good	nil	5/20
	P.O.J. 2725	Good	nil	nil
	P.O.J. 2727	Good	nil	1/20
	P.O.J. 2875	V. good	nil	5/20
	P.O.J. 2878	Good	nil	nil
	P.O.J. 2940	Good	+	14/37
H.A. Ilett's farm, Childers	D. 1135	Fair	+	..
	M. 1900 S.	Fair	+	..
	M. 189	Fair	nil	..
	28 N.G. 14	Poor	+++	..
	28 N.G. 18	Fair	+	..
	28 N.G. 47	Fair	+++	..
	28 N.G. 72	Fair	+	..
	28 N.G. 78	Fair	+++	..
	28 N.G. 96	Good	+	..
	28 N.G. 98	Poor	+++	..
	28 N.G. 110	Good	+	..
	28 N.G. 262	Fair	+	..
	28 N.G. 263	Good	+++	..
	28 N.G. 269	Bad	+++	..
	28 N.G. 279	Fair	+++	..
	28 N.G. 282	Bad	nil	..
	Q. 813	Fair	nil	..
	B. 417	Very good	nil	0/38
Windermere Plantation, Bundaberg	D. 1135	Fair	+	..
	M. 1900 S.	Fair	+++	..
	M. 189	Fair	+	..
	Q. 813	Good	nil	0/44
	Q. 822	Good	nil	0/34
	Q. 855	Fair	+	2/42
	Q. 1098	Very good	nil	0/36
	"A" 42	Fair	nil	2/15
	S.J. 7	Fair	nil	..
	H.Q. 409	Poor	nil	0/34
	U.H. 1	Poor	nil	..
	U.H. 4	Fair	nil	..
	U.D. 62	Poor	nil	..
	Manoa 304	Fair	nil	..
	26 C. 216	Fair	nil	0/62
	Ba. 11569	Poor	+	7/19
	S.C. 12/4	Good	nil	0/30
	Oramboo	Bad	nil	2/33
	C.H. 64/21	Fair	nil	..
	Tekcha	Fair	nil	..
	Co. 244	Fair	nil	..
	Co. 285	Fair	nil	..
	Co. 287	Fair	nil	..
	Co. 301	Fair	nil	..
	Co. 303	Good	nil	..
	Shah. 10	Fair	nil	..
	P.O.J. 36	Poor	nil	..
	P.O.J. 2722	Fair	nil	1/37
	P.O.J. 2725	Fair	nil	0/41
	P.O.J. 2727	Good	nil	0/48
	P.O.J. 2747	Bad	+++	..
	P.O.J. 2883	Good	nil	..

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Discussion of Results.

As will be seen from the relative behaviour of Q. 813 and the guard row canes, the incidence of the disease varied considerably in these three plots. The resistance of Q. 813 has been adopted as the approximate standard around which varieties are accepted or rejected. On this basis, it is pleasing to note that the resistance of the promising P.O.J. canes (2722, 2725, 2875, and 2878) is highly satisfactory under the most rigorous conditions, while P.O.J. 2883 is also satisfactory. The New Guinea canes of the Brandes collection have performed unsatisfactorily; the only variety with satisfactory resistance is lacking in vigour. The thin canes of the U.H. and Co. type have proved highly resistant, but are generally unsatisfactory as to fibre content, vigour, and/or sugar content. The variety B. 417 stands out as the most promising of the canes which have not previously been tested in these trials.

Red Stripe.

Owing, presumably, to the copious and continuous spring rains, red stripe disease was much less in evidence than it has been for a number of years, and damage was practically non-existent. By dint of special precautions, a reasonably satisfactory resistance trial was concluded, but other red stripe experiments were abortive.

A series of pairs of soil samples were taken from adjacent light and heavy top rot patches of the previous year. In every case the moisture-holding capacity (as determined by the centrifugal method) was less in the heavily infected patches than the light. Further work on this interesting aspect of the question could not be continued this year on account of the absence of such patches. The converse observation, however, indicated that over-wet patches in the field do not accentuate the incidence of the disease.

RESISTANCE TRIAL.

Location : South Johnstone Station.

Plan : Duplicate plantings of 20 stools of each variety planted closely, late fertilization, and every third row a guard row of P.O.J. 2878.

Planted : 5th September, 1933. Counts concluded, April, 1934.

Variety.	Total Stalks.	Dead Stalks.	% Dead Stalks.
S.J. 4	128	9	7
S.J. 2c	27	6	22
H.Q. 426	132	7	5
Badila	94	12	13
Oramboo	77	7	9
S.C. 12/4	71	7	10
P.O.J. 234	178	3	2
P.O.J. 2714	123	46	37
P.O.J. 2722	83	18	22
P.O.J. 2725	197	5	3
P.O.J. 2727	116	32	28
P.O.J. 2747	127	6	5
P.O.J. 2875	54	12	22
P.O.J. 2878	593	105	18
P.O.J. 2940	95	17	18

Discussion of Results.

Owing to the prevalence of moth borer and the consequent death of stalks as a result of the activities of this pest, accurate determinations of each death due to top rot could not be made. Results of duplicates were somewhat irregular, suggesting that in future trials four replications would be desirable. Nevertheless, it is apparent that the varieties P.O.J. 234, P.O.J. 2725, and P.O.J. 2747 are satisfactorily resistant, while P.O.J. 2722, P.O.J. 2727, and P.O.J. 2875 would require careful treatment even if they proved satisfactory from other points of view. The remaining varieties performed in accordance with previous experience.

Leaf-scald.

Leaf-scald was not much in evidence during the year. An outbreak of the disease which was found in the variety Mahona on four farms in the Bingera district appears to have been eradicated by the ploughing-out of the infected blocks.

A resistance trial was set out at the Meringa station, but, owing to the decision to transfer the cane-breeding section from South Johnstone to Meringa, the trial was ploughed out. Such tentative conclusions as could be drawn again indicated that any cross which contained the variety N.G. 24 as a parent contained an unduly large proportion of susceptible progeny. A further trial was planted on 28th August at Hambledon. This includes one hundred seedlings of each of seven crosses, as well as twenty-two individual varieties.

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A small amount of work with the improved leaf-scald medium has been carried out. This indicates that in addition to improved growth obtainable by the adjusting of the oxidation-reduction potential, further improvement is readily obtainable by the addition of a growth-promoting substance which is produced by the organism in culture. This substance is precipitated by alcohol, and may be kept relatively unchanged for several months either in alcohol or dry. Samples of this substance have been sent abroad for testing with other strains of the causal organism of leaf-scald.

Downy Mildew.

A further resistance trial is being carried out in the Lower Burdekin district. Inasmuch as the method of conducting these trials appears to be quite satisfactory, a plan of the layout is included herein. Duplicate plantings of 20 setts of each variety are made, with diseased setts of B. 208 set out at regular intervals; the latter are double-planted to ensure satisfactory germination. Trials are conducted under good agricultural conditions and irrigation is necessary to ensure reasonably rapid spread of the disease.

Location: Kalamia Estate. *Planted:* 21st March, 1934.

Plan.

Korpi	*****	P.O.J. 2722	*****	B. 208	*****	P.O.J. 2747	*****
*****	P.O.J. 2722	*****	S.J. 4	*****	S.J. 7	*****	P.O.J 2878
P.O.J. 2878	*****	Oramboo	*****	Badila	*****	P.O.J. 2722	*****
*****	P.O.J. 2747	*****	S.J. 4	*****	B. 208	*****	S.J. 7
Korpi	*****	P.O.J. 2727	*****	Badila	*****	Oramboo	*****

*= stool of diseased B. 208.

The strike was only fair owing to stock breaking into the field. On inspection on 25th September, diseased stools were found as follows (the total stools being given in brackets):—P.O.J. 2722, 15 (28); P.O.J. 2878, 7 (33); B. 208, 4 (30); P.O.J. 2727, 2 (30); P.O.J. 2747, 1 (36); remainder nil.

The susceptibility of P.O.J. 2878 is again emphasised, while P.O.J. 2722 appears very highly susceptible. The trial conducted last year has been ratooned; only 25 per cent. of the stools of P O.J. 2940 ratooned and all are diseased, while only 70 per cent. of the stools of P.O.J. 2878 ratooned, and of these one-half are diseased.

Dwarf Disease.

The investigation of this disease has been carried on in Mackay by Mr. McDougall, but it has not been made a major project owing to the conclusions formed after a comprehensive field survey of the situation. It was found that the disease was confined to the Homebush area, and that secondary spread of the disease appeared to be confined to low-lying fields or parts of fields. As a result of this survey, it would not appear likely that dwarf disease will prove of economic importance in other and more elevated localities. Two theories might be advanced to explain the restricted incidence of the disease:—(1) The disease is primarily a disease of a weed growing in such localities and is occasionally spread from weed to cane by the accidental feeding of an insect which does not normally feed on cane; (2) it is transmitted from cane to cane by an insect which completes its life history on a weed common to this locality.

Attempts to transmit the disease by several different mechanical means have been unsuccessful. Experiments with insect transmission, involving the caging of various insects upon diseased plants and then transferring them to healthy plants of P.O.J. 2714 have also proved unsuccessful to date. In this latter portion of the investigation the following insects have been utilised:—*Perkinsiella saccharicida, Lophops australis, Perigrinus maidis, Aphis sacchari, Nermoskellia* (*Alleurodes*) *bergi*, the pink mealy bug, and several unidentified Hemiptera collected from grasses. Most of the latter, however, could not be induced to feed on cane. This work will be continued during the coming season.

A considerable amount of information has been collected regarding the early symptoms and the growth and behaviour of dwarf-infected cane, and in this connection it is interesting to note that prolonged masking of symptoms has been observed in plants arising from diseased setts of H.Q. 426 and Malagache. Attempts to bring about control of the disease by warm water treatment of setts, as in the case of chlorotic streak disease, were unsuccessful.

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Fiji Disease.

A new outbreak of Fiji disease was discovered in an area adjoining the City of Bundaberg, in December. Prompt measures were taken by carrying out a survey of contiguous areas and quarantining the infected locality. Periodic inspections will be resumed in the area as soon as the condition of the crops is favourable. A resistance trial in which were included all promising new varieties has been set out, but will be ratooned and carried on another year before counts are made.

Owing to the transfer of Mr. R. W. Mungomery from Bundaberg to Meringa, the investigation of various phases of insect transmission of Fiji disease has had to be discontinued. It has, however, been demonstrated that the disease may be spread by adult leaf-hoppers which have been bred on diseased cane—i.e., that transmission is not confined to nymphs. On the other hand, no transmission again resulted when insects which had fed on diseased cane in the adult stage only were used. Leaf-hopper population counts have been continued in fields in various parts of Bundaberg, and these confirm the previous year's finding that the greatest increase in leaf-hopper population takes place in the period January–April, although a few nymphs have been found in odd places throughout the year. Concerning these counts, Mr. Mungomery states: "These counts have also shown that the resistance displayed by some varieties such as Q. 813 is probably due to some inherent factor for resistance rather than to their being always less infested by leaf-hoppers than some of the very susceptible varieties such as M. 1900 seedling."

For some unexplained reason apparent transmission has been less extensive this year and periods of incubation much longer than in previous years. An extreme case occurred in the Pathology plot in Brisbane. At the beginning of March, 1933, 12 adult hoppers which had been caged on diseased cane were caged on each of 6 stalks of E.K. 28, a total of some 6–8 nymphs being inadvertently included among the six cages. No symptoms were observed, but on cutting and planting this cane twelve months later three setts gave rise to Fiji-diseased stools. No other Fiji disease was present in or near the garden during this period.

Root Diseases.

For some time it has been apparent that in the Bundaberg district crop growth has been limited by some undetermined factors, at least with certain varieties. In spite of adequate fertilization and cultivation and with a rainfall better than the average for the year, numerous fields may be observed where the crop seems not to have made the best use of conditions by any means. This has been particularly true of the variety Q. 813 in the red volcanic soils of the Woongarra. Our attention has also been repeatedly directed to the remarkable disparity between the size of stools in a circumscribed area, even though the planting material has been remarkably uniform.

In considering this problem the most obvious point is the fact that in many such fields sugar-cane has been grown continuously for upwards of forty years, with no suggestion of rotation such as has been found a necessary adjunct to the permanent agriculture of older countries. Under such conditions it is natural to expect that the soil would have become "'sick" to a greater or less extent, and that root rots would take some toll of the growing crop. Accordingly, it was decided to initiate a series of investigations which would clarify the situation.

Soil Sterilization.

A preliminary experiment was carried out in which 2-eye setts of Q. 813 were grown in tubs containing 200 lb. of "sick" soil from the Bundaberg Sugar Experiment Station. The trial was conducted in triplicate and soil was sterilized by steaming (1-1½ hours at 200° F.) or formalin (600 lb. of soil watered with 1 pint of formalin in 5 gallons of water). All tubs were very heavily fertilized and irrigated. The cane was grown for a period of five months and throughout the whole period the cane growing in the sterilized soil was much more vigorous than that in the check pots. This qualitative experiment was then repeated in smaller pots containing about 30 lb. dry soil. The treatments were again steam and formalin sterilized soil, with checks, but in addition one series was included which consisted of 75 per cent. steam-sterilized soil mixed with 25 per cent. unsterilized. For the purposes of comparison the variety P.O.J. 2878 was also included. Growth measurements were taken and the experiment discontinued when the growth curve commenced to flatten (indicating that the plants were becoming pot-bound). Pots were well watered and very heavily fertilized and top-dressed at regular intervals so that plant foods could not become a limiting factor. One-eye setts were used and treatments were in triplicate.

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At the age of three months the plants were washed from the pots, weighed, and dissected, with the following results (average of 3 pots):—

Variety.	Treatment.	Number of Shoots.	Weight Fresh Roots.	Weight Fresh Tops.
			grams.	grams.
Q. 813	Steam-sterilized	4·3	140	178
Q. 813	Check	1	7·5	30
P.O.J. 2878	Steam-sterilized	3·6	166	155
P.O.J. 2878	Check	2·6	42	72
Q. 813	Formalin-sterilized	4·7	132	148
Q. 813	Mixed Soil	1	23	53

It will be seen that there is a marked difference in yield between sterilized and non-sterilized pots, particularly in the case of Q. 813. The plants in the mixed soil showed rapid early growth but soon came to a standstill, demonstrating that the effects of the sterilization are biological and not chemical. In addition to the variations in yield a marked difference in type of roots was obvious; in the sterilized pots white fleshy vigorous roots were numerous, while in the unsterilized and mixed pots the roots

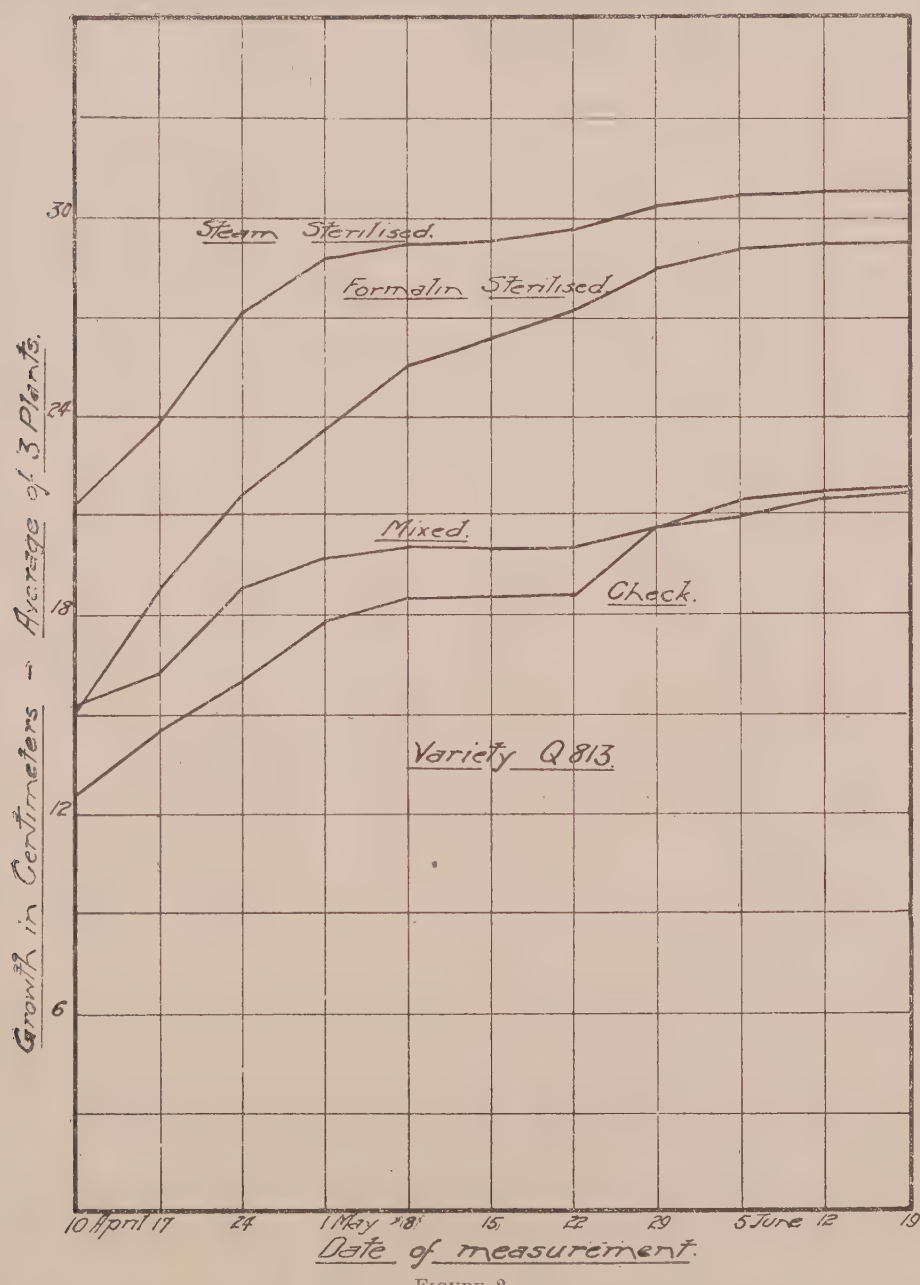

FIGURE 2.

were sparse, woody, and carried numerous red lesions. For a comparison in the growth rates of Q. 813 in the various types of soil see the graphs reproduced in Fig. 2. In the case of P.O.J. 2878 the differences, although not nearly so marked, were surprisingly great.

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It is evident even from these small experiments that indefinable root rots must frequently be limiting factors in the growth of cane on these old lands, and the investigations are being continued on a somewhat larger scale with a view to ascertaining magnitude of losses, the effects of crop rotation, &c., while the possibility of utilizing this method of testing varietal resistance will also be explored.

Although having no practical application at the moment, this indication of the existence of "sick" soils in our old sugar lands opens up some interesting lines of thought. For example, with the increasing popularity of Mitscherlich and other fertilizer tests which depend on the use of indicator plants, the question arises as to what indicator plant shall be used. Shall it be a plant resistant to root rots or susceptible, or will it be necessary to have several plants corresponding to the susceptibility or resistance of the several varieties grown? Further, in the interpretation of the relation of available plantfoods and response to fertilizer application, how often are anomalous results due to the superposition of a biological limiting factor? Unquestionably the future programmes of experimental work in the sugar experiment stations of the world must pay greater attention to the biological constitution of the soil, an aspect which has been neglected in the face of more obvious requirements.

Type of Planting Material Trials.

In order to determine whether the differences in stool size of adjacent stools might be due to obvious initial differences in the type of planting material used, a trial was set out at the Bundaberg Station in which eight different types of planting material were used and every precaution was taken to ensure that the members of each type were uniform as to size, weight, and number of eyes, all of which were sound. The variety used was Q. 813 and the different types of material were as follows:—

1. Over-succulent 3-eye plants of average weight 10·32 oz.
2. Poor to medium grown 3-eye plants of average weight 5·35 oz.
3. As in No. 1, but 2-eye plants of average weight 7·68 oz.
4. Trashbound immature plants of average weight 7·6 oz.
5. As in No. 1, but double-planted with plants as in No. 2.
6. As in No. 1, but dried in a bag for 8 days prior to planting. Average weight 10·5 oz.
7. Over-mature cane from butts of standover cane 3-4 eyes. Average weight 8·48 oz.
8. From stools showing symptoms of root disease, 3-eye plants of average weight 5·05 oz.

Planted: 25th August. *Harvested*: 8th October, 1934.

Plots: 2 rows of 25 setts each, length of rows 50 feet.

Plan: 4 randomised blocks.

Discussion of Results.

Immediately prior to harvesting, all stools were examined individually and the number of stalks per stool and the length of millable cane per stool recorded. A full summary of these results is set out in Table I.

It will be seen from that portion of the Table which sets out the distribution of stalks per stool that there has been a very great variation in the numbers of stalks per stool. With the exception of the trashbound cuttings (in which the number of stalks per stool is definitely low), the distribution is remarkably uniform as from type to type and the variation within each type closely resembles the variation in the whole population. It appears from this trial that the variation in stool size in the field cannot be attributed to obvious differences in the planting material.

It is not proposed here to examine closely the yields obtained. On a qualitative basis it is apparent that it is a better practice to use moderately well-grown cane for plants and that three-eye plants are to be preferred to two-eye plants. The increase in yield of No. 5 over No. 1 is possibly significant and in places where poor germination is probable this system of planting is worth further investigation.

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Table I.—Summary of Results of Preliminary "Type of Planting Material" Trial. Bundaberg Station.

Type of sett.		Stalks per stool. 1	2	3	4	5	6	7	8	9	10	11	Total Stools.	Total Stalks.	Feet of Cane.	Weight of Cane.
																cwt. qr. lb.
Over-succulent 3-eye	1	2	1	8	10	4	8	7	1	1	1	1	44	223	1,143	6 3 12
	2	1	3	2	7	11	5	8	2	..	2	..	41	218	914	4 2 7
	3	..	3	7	9	11	10	6	1	1	..	..	48	237	1,021	4 1 8
	4	1	2	4	12	12	10	4	1	1	..	..	47	230	841	4 1 10
Total		4	9	21	38	38	33	25	5	3	3	1	180	908	3,919	20 0 9
Medium 3-eye	1	2	..	1	9	12	12	8	3	..	1	..	48	263	1,109	6 1 17
	2	2	1	6	12	12	10	4	1	..	..	..	48	226	953	4 2 15
	3	1	1	11	19	5	9	3	1	..	..	..	50	220	910	4 2 0
	4	..	..	3	5	13	12	5	3	2	1	..	44	253	963	4 3 18
Total		5	2	21	45	42	43	20	8	2	2	..	190	962	3,935	20 1 22
Over-succulent 2-eye	1	..	2	3	11	6	13	6	1	2	1	..	45	243	1,172	6 1 21
	2	1	2	6	6	10	7	3	1	..	..	..	36	168	631	2 3 8
	3	1	3	9	9	11	6	3	1	..	..	..	43	192	868	4 1 0
	4	..	1	7	3	8	7	8	..	2	1	..	37	201	801	3 3 2
Total		2	8	25	29	35	33	20	3	4	2	..	161	804	3,472	17 1 3
Trashbound ..	1	4	6	5	6	7	6	5	1	1	..	1	42	189	724	4 0 12
	2	7	5	12	12	7	3	3	..	..	..	..	49	175	594	3 0 0
	3	3	3	8	13	9	5	3	..	..	..	..	44	178	618	3 0 0
	4	4	2	6	9	11	6	3	1	..	1	..	43	192	750	3 2 7
Total		18	16	31	40	34	20	14	2	1	1	1	178	734	2,686	13 2 19
Double-planted	1	1	..	4	9	8	14	6	5	2	1	..	50	283	1,382	6 3 9
	2	..	6	6	10	5	11	6	4	1	..	..	49	244	986	4 1 26
	3	..	1	2	6	13	12	11	2	3	..	..	50	289	1,326	6 1 12
	4	..	..	5	6	10	10	11	7	..	..	1	50	293	1,338	6 0 0
Total		1	7	17	31	36	47	34	18	6	1	1	199	1,109	4,032	23 2 19
Dried	1	..	..	3	1	5	3	5	5	2	2	1 (12)	26	173	596	3 3 12
	2	1	1	4	8	10	11	..	4	2	..	1	42	224	1,013	4 2 17
	3	2	..	7	6	9	9	2	..	1	1	1	38	190	709	3 3 22
	4	1	..	4	12	9	3	6	7	..	..	..	42	222	938	4 2 3
Total		4	1	18	27	33	25	13	16	5	3	3	148	809	3,256	16 3 26
Over-mature ..	1	..	..	2	10	9	11	10	3	..	..	1 1 (13)	47	275	1,267	5 3 20
	2	..	2	8	7	12	10	5	2	..	1	..	47	237	891	3 2 3
	3	2	7	9	10	10	7	2	..	..	..	..	47	189	628	2 3 16
	4	1	1	4	10	7	13	7	2	3	..	..	48	258	1,176	5 2 5
Total		3	10	23	37	38	41	24	7	3	1	2	189	959	3,962	17 3 16
From Stools Affected with Root Disease	1	..	1	4	13	14	9	4	1	..	..	..	46	227	964	4 2 20
	2	4	3	6	6	13	7	5	2	..	1	..	47	220	963	3 3 25
	3	1	2	10	15	13	5	2	..	1	..	..	49	213	771	3 1 19
	4	..	4	9	7	6	8	8	3	..	1	..	46	231	888	4 1 5
Total		5	10	29	31	46	29	19	6	1	2	..	188	891	3,586	16 1 13

Resistance to Root Disease.

In last year's report attention was directed to a root disease of the Marasmius type which was characterised by a reddish spotting of the leaves, particularly in the variety Q. 813. A preliminary planting of promising varieties in an infected field was carried out, the following being utilised:—Co. 281, Co. 290, P.O.J. 234, P.O.J. 979, P.O.J. 2379, P.O.J. 2725, with Q. 813 interplanted. These are all strong-rooting varieties and although leaf systems were present in Q. 813, the new varieties were free.

Sugar Deterioration.

A considerable amount of investigation of factors contributing to the deterioration of raw sugars has been carried out in four mills, but data are as yet incomplete.

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The Northern Cane Grub (*Lepidoderma albohirtum*).

Damage to cane as a result of the depredations of the cane grub was unusually severe during the past season due to weather conditions favouring a high percentage of survival among young grubs. Especially was this so in areas such as Mulgrave, Hambledon, and Mourilyan, &c., where systematic fumigation was not carried out in all infested areas, and where, as a consequence, a large amount of damage has occurred. This damage might have been considerably augmented had not these areas received continued falls of rain until late in the season when the majority of grubs had finished feeding. These rains served to keep the cane alive until the mills commenced crushing operations, but even under these favourable conditions some fields of cane were completely destroyed. In other areas such as Tully, Goondi, and South Johnstone, where closely-supervised fumigation campaigns are conducted each year, the infestation was not unduly high. In all these areas wet weather interfered considerably with fumigation work, and it was not possible to treat all fields which needed fumigation. This circumstance, by allowing a large survival, will most likely influence infestation during the coming year, unless the remaining spring months are particularly dry.

In the Burdekin district severe grub damage occurred on farms near Giru, and grub infestation is likely to increase unless some approved form of control is instituted against the pest.

This high grub infestation has brought in its wake the usual band of opportunists, who take advantage of the embarrassment of some growers to foist on them reputedly infallible grub cures, but as usual none of these treatments has proved effective. One such treatment, consisting in the application of common salt to the infested areas, became decidedly popular on account of its cheapness and the ease with which the material could be applied; however, notwithstanding the application of large quantities of this chemical, grub damage in treated fields was entirely comparable with that of untreated fields.

The first emergence of beetles at Meringa during the 1933 season was recorded on 16th November, but they were not in full flight until 3rd December. At Highleigh the flight was somewhat earlier, and beetles were flying in large numbers by 20th November. The emergence was very protracted and the beetle flight abnormally large, due, no doubt, to the wet conditions of 1933 favouring a high rate of survival. Correlated with this heavy beetle flight the grub infestations experienced during the early part of 1934 were correspondingly severe, and a number of instances were recorded where fields of cane carried an average population of upwards of 30 grubs per stool.

In the Mackay area the beetle flight was very light, and there was little damage caused by grubs.

Grub Maps.

With the idea of having true, readily accessible and comparable records of the infested areas, and following the variation both in intensity and location of grub infestation from year to year, a grub map of the infested areas from Hambledon to Tully has been completed. This has been done with the co-operation of the Field Chemists of Goondi, South Johnstone, and Tully mills, and on the map are shown grub-infested fields of varying degrees of intensity—i.e., heavy, medium, and light—as well as all fumigated areas. By compiling such grub maps over a number of years, it may be possible to account for the migration of beetles which undoubtedly occurs from time to time, as well as to evaluate the efficiency of the many factors operating against this pest.

Fumigation.

Having regard for the high grub populations and also for the exceptionally heavy and almost continuous rainfall from January to May, it is not surprising that fumigation was beset with considerably more difficulties than is usual. Indeed, attempts to fumigate many fields had to be abandoned owing to excessive soil moisture. However, where fumigation was carried out good kills of the grubs were obtained and, although the unseasonably cool weather has not been conducive to good growth, cane that was fumigated sufficiently early has harvested well.

Four fumigation trials were set out in March and April, 1934, by Mr. Buzacott. Owing to the continual rain at the beginning of the year it was impossible to fumigate until the grubs had already severely checked the cane. Furthermore, there was very little hot weather after March, and consequently the cane made little growth even after the grubs were killed. This was particularly obvious at the Edmonton plot, where the fumigated cane looked strikingly green and luxuriant, whilst the controls were brown and dead, but in spite of this there was only a difference of two and a-half tons per acre in the weight of the cane. In this plot a maturity test showed that the fumigated cane was not ripe when harvested and the control cane was over-mature. One plot had to be abandoned,

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EDMONTON PLOT.

Plan.

PDB	CS_2 + PDB	Control	CS_2
CS_2	Control	CS_2 + PDB	PDB
CS_2 + PDB	CS_2	PDB	Control
Control	PDB	CS_2	CS_2 + PDB

Treatments.—Where carbon disulphide and paradichlorbenzene were used together they were mixed in equal parts and 4·6 cc. doses were injected at the rate of 4 per stool at a depth of three inches. The carbon disulphide when used alone was injected in a similar manner using the same dosage, while the paradichlorbenzene when used alone was injected with a Gelling Solid Injector depositing ¼ oz. doses.

Harvested.—4th July, 1934.

Summary of Results :

Treatment.	Average number grubs per stool alive after fumigation.	Yield.	C.C.S.
		Tons.	Per cent.
CS_2+PDB, 1 : 1	·44	23.75	16.4
CS_2	2·94	25.18	15.3
PDB	5·31	22.08	14.9
Control	7·62	21.07	14.0

Discussion of Results.

Statistical analysis of the results has shown that insofar as the mortality of the grubs is concerned the mixture of carbon disulphide and paradichlorbenzene is significantly better than the other treatments, while CS_2 alone is significantly better than P.D.B. alone, which in turn is significantly better than the control plots. It is obvious then that under the conditions of the experiment the mixture is the most effective fumigant.

The differences in yield, Mixture-Control, CS_2-Control, and CS_2-PDB are significant as also is the c.c.s. difference, Mixture-Control. The yield results, however, are disappointing and cannot be accepted as a criterion of the results to be expected from fumigation. The cane in both the mixture and the CS_2 plots was green and succulent in contrast to the dying cane in the check plots, but the results obtained may be explained by the facts that—

(1) The cane in the controls was over-mature and that in the plots treated with mixture and with CS_2 was immature when the plot was harvested ;

(2) No hot weather was experienced after fumigation, and consequently the cane had made practically no growth since then ;

(3) Rats were very bad in the block and were damaging the more succulent fumigated cane rather than the harder control cane. Furthermore, owing to the exceptionally wet period experienced at the beginning of the year, the fumigation had to be carried out after the grubs had already done considerable damage, and it required a considerable time under the poor growing conditions for the fumigated cane to throw out new roots ;

(4) Perhaps the biggest factor influencing the yields was the fact that the control canes having no roots left were in many cases not cut but simply pulled out of the ground, the butt remaining on the stick. This factor must have made a considerable difference to the weight, particularly as one control block, which showed practically no grub damage, cut out lighter than any of the others.

It is considered that if the block had been harvested in September or October, very much better results would have been obtained, but this was not possible because that portion of the block outside the trials was so badly grub-damaged that it was necessary to harvest it as soon as the mill commenced crushing.

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Plan.

GORDONVALE PLOT.

CS_2 + ODB 2 : 1	CS_2 + ODB 1 : 1	CS_2 + PDB 1 : 1	Control
CS_2 + ODB 1 : 1	CS_2 + PDB 1 : 1	Control	CS_2 + ODB 2 : 1
Control	CS_2 + ODB 2 : 1	CS_2 + ODB 1 : 1	CS_2 + PDB 1 : 1
CS_2 + PDB 1 : 1	Control	CS_2 + ODB 2 : 1	CS_2 + ODB 1 : 1

Treatments.—The fumigants comprised carbon disulphide plus paradichlorbenzene in equal parts; carbon disulphide plus orthodichlorbenzene in equal parts; and two parts of carbon disulphide plus one part of orthodichlorbenzene. A dosage of 4·6 ccs. was injected in the case of each fumigant, four injections per stool, three inches from the stool and at a depth of three to four inches.

Summary of Results.

Treatment.	Average Number of Grubs per Stool Alive after Fumigation.	Yield.	C.C.S.
		Tons.	Per cent.
CS_2 + PDB 1 : 1	·62	23.9	17.9
CS_2 + PDB 2 : 1	·94	20.9	17.3
CS_2 + ODB 1 : 1	·88	18.6	17.7
Control	3·81	19.2	16.2

Discussion of Results.

Grub Mortality.—All treatments were significantly better than the control and the mixture of CS_2 and PDB was significantly better than either of the mixtures containing orthodichlorbenzene. *Weight of Cane.*—CS_2 and PDB, and CS_2 and ODB (2 : 1) plots were significantly better than the latter. *C.C.S.*—CS_2 and PDB and CS_2 and ODB (1 : 1) plots were significantly better than the controls. It would appear from this trial that the mixture of carbon disulphide with paradichlorbenzene is superior to that with orthodichlorbenzene. However, due to the late fumigation which was rendered necessary this year, the results require confirmation.

HIGHLEIGH PLOT.

Plan.

CS_2 + PDB 2 : 1	CS_2	Control	CS_2 + PDB 1 : 1
Control	CS_2 + PDB 1 : 1	CS_2 + PDB 2 : 1	CS_2
CS_2 + PDB 1 : 1	Control	CS_2	CS_2 + PDB 2 : 1
CS_2	CS_2 + PDB 2 : 1	CS_2 + PDB 1 : 1	Control

Treatments.—Fumigants were used as follows:—Carbon disulphide plus paradichlorbenzene 1 : 1 and 2 : 1, and carbon disulphide alone. Injections were made as in the Gordonvale plot.

Results.

This trial has not yet been harvested. The number of grubs per stool remaining alive after fumigation was CS_2+ PDB (1 : 1), ·31; CS_2+PDB. (2 : 1), ·69; CS_2, ·75; and Control, 3·19.

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Discussion of Results.

The three treatments are all significantly better than the control, but there is no significant difference between the treatments. Unquestionably, however, there is a considerable possibility that the lateness of the fumigation favoured the carbon disulphide alone owing to the consequent concentration of the grubs under the stool.

Fumigation Trial For Percentage Control.

On the 1st May four rows of grubby cane at Edmonton were injected with four different mixtures of carbon disulphide and para- or ortho-dichlorbenzene, and dug seven days later, a count of the dead and living grubs being made with the following result :—

Fumigant.	Grubs Dead.	Grubs Alive.	Per cent. Control.
CS_2 + PDB (2 : 1 mixture)	138	0	100
CS_2 + PDB (1 : 1 mixture)	134	2	98·5
CS_2 + ODB (2 : 1 mixture)	136	7	94·4
CS_2 + ODB (2 : 1 water-soluble)	134	6	95·7

The carbon disulphide-paradichlorobenzene and carbon disulphide-orthodichlorobenzene mixtures were all injected in 4·6 cc. doses four to a stool, three inches from the stool and three inches deep. The soil was red schist and fairly wet at the time of injection. As will be seen by reference to the above table there is no particular difference in favour of any one of the treatments, due possibly to the lateness of the fumigation.

In considering such results as are furnished by the four fumigation trials set out above, it must be emphasised that the season was unusually wet, the number of grubs high, and fumigation was, of necessity, carried out some two months later than it should have been. It is obvious therefore that it would be unwise to attempt to draw rigid conclusions.

Treatment of Soil with White Arsenic.

The use of white arsenic sprinkled on the soil has achieved some popularity as a means of controlling the northern cane grub among some of the suppliers to the Invicta Mill. At the request of the Local Pest Board six trials were laid down by Mr. Buzacott at Giru and Rita Island during 1933. The application is usually made at the rate of about 80 lb. per acre by farmers, but in these trials amounts of 80 and 200 lb. per acre were used, the arsenic being sprinkled along the drills after planting. Only three of these plots became infested by grubs to any degree and one of the three had to be abandoned on account of damage by stock. On the basis of these trials, and a similar one on the Ingham line, which was dug during May, it would appear that the application of 80 lb. per acre is virtually useless. Using dressings of 200 lb., a mortality of about two-thirds was obtained with an average infestation of six grubs per stool so that the treatment might have some value in light infestations. Concerning the treatment as a whole, however, Mr. Buzacott says : " From the appearances at the last inspection, and from the number of grubs obtained in treated plots at the last diggings, it does not appear that arsenic is offering sufficient economic control to warrant its use."

To gain further information on the use of arsenic, a series of five further plots were established in the Ingham line district of the Invicta Mill. In some of these plots the arsenic was sprinkled along the drill after planting, as before, whilst in others the arsenic was placed in the drill before planting. In the latter case, however, bad strikes have resulted. In this further series of plots, treatments of 200 lb. and 300 lb. of arsenic per acre have been used as against treatments of 80 lb. and 200 lb. per acre in last series.

Collection of Beetles from Light Traps.

It is realised that in the entomological world the general subject of the control of insect pests by trapping has a faint aura of disrepute. Nevertheless it has been decided to explore the possibilities of this method as applied to the greyback beetle, but with the full realisation that the investigation must be carried out on a statistical basis, and that the relationships between numbers trapped, numbers of potential pests untrapped, and unit capacity for causing damage, must be constantly borne in mind. An important factor influencing this decision is the fact that the beetles feed and mate for a period of two weeks after emergence, before oviposition commences.

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The problem of a suitable trap was solved with complete success during the 1933 beetle flight. The trap evolved consists essentially of a large surface of white-painted galvanised iron, provided with a collecting hopper at the base and lit in the centre by an electric or other light. The trap is placed in position about 15 feet from the selected feeding tree, the weeping fig, *Ficus benjamina*, being the most suitable on account of its attractiveness to the beetle, suitable shape, and the ease with which it may be shaken. After dusk the light of the trap is switched on and the boughs of the tree are shaken, and such beetles as are feeding then literally stream to the light and are precipitated into the hopper. In the following table are given the numbers of beetles caught in this manner in a series of experimental trappings with a single trap; relative proportions of male and female beetles are also given:—

Date.	Locality.	Beetles Caught.	Percentage Females.
November 16th	Meringa ..	94	53
November 17th	Meringa ..	80	62
November 21st	Meringa ..	187	53
November 24th	Highleigh ..	1,200	50
November 30th	Meringa ..	329	50
December 4th	Meringa ..	2,400	..
December 5th	Meringa ..	9,400	..
December 6th	Meringa ..	2,000	..
December 7th	Meringa ..	3,200	..
December 12th	Woree ..	2,000	..
December 13th	Meringa ..	11,000	60

A large-scale and long-range experiment has been planned for the Meringa district and an attempt is being made to determine the order of the probable beetle population of this area. It is proposed to establish readily accessible feeding trees throughout the area, and an endeavour will be made to remove any attractive feeding trees from the surrounding forest country. In other words, an attempt will be made to induce the entire beetle population to feed on readily accessible trees. In connection with population studies diggings have been carried out in various soil types, and so far these indicate that in the Meringa area most of the grub infestation occurs in the canefields and comparatively few grubs are present in the surrounding forest country. Excavations were commenced in May, but it was evident that the death rate of the grubs was high. This rate, though decreased, was still comparatively rapid during June, but later became more gradual. In Fig. 3 is represented graphically the decline in intensity of population for the three months June-August.

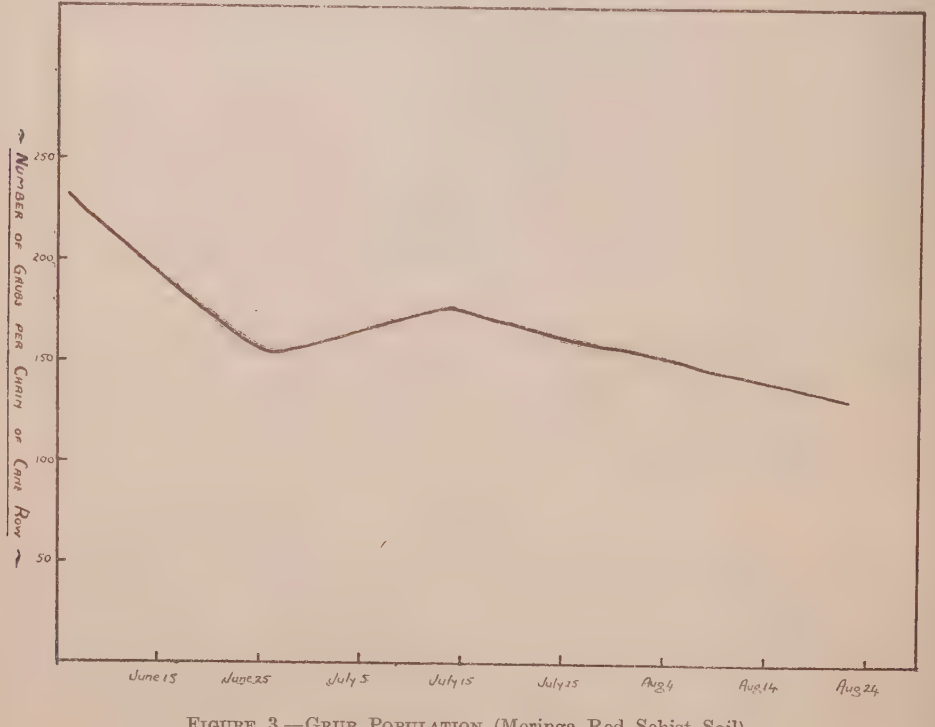

Figure 3.—Grub Population (Meringa Red Schist Soil).

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This heavy and irregular mortality demonstrates the futility of attempting to make, from early grub diggings, estimates of the probable beetle population emerging in a given area. To do this with any degree of accuracy, it will be necessary to base all calculations on diggings carried out during the prepupal, pupal, and early beetle stages, and then being guided by results from subsequent diggings, to make due allowance afterwards for any mortality occurring in the beetle stage underground, which often happens during droughty spring months.

For the project outlined above it has been necessary to propagate a large number of weeping fig trees, and in order to furnish large trees and to enable this work to be pushed forward as quickly as possible, we have found that the most effective method is to bind large branches from 1-2 inches in diameter with sacking puddled in very moist soil. If this be done prior to the commencement of the wet season, a large development of adventitious roots is encouraged, and if a few incisions be made in the bark of the branch before banding, the roots develop much more quickly. When a good root development is apparent, and the roots are penetrating the outer layer of sacking, the branch is severed just below the banding, and the branch planted in its final position in the field, or, if the weather be dry, in a drum of soil where it can be watered regularly. Such branches soon shoot and develop into large trees which are three or four years in advance of those grown from small cuttings or seeds.

Varietal Resistance.

It is pleasing to be able to record that the variety S.J. 4, a seedling raised by the Bureau at the South Johnstone Station, has exhibited a considerable degree of resistance to light and moderate grub infestation. Diggings have been carried out in order to ensure that this apparent resistance was not due to the variety having in some way escaped the attention of beetles at the time of oviposition. The results of such a digging, in which stools were dug from the first two rows of contiguous plots of S.J. 4 and Clark's Seedling, were as follows :—

		Total.	Average per stool.
S.J. 4	7 4 1 7 5 5 7 2 4 7	49	6·2
	14 3 10 9 6 13 5 3 7 5	75	
Clark's Seedling	4 1 5 1 7 8 4 1 2 3	36	3·9
	2 9 2 2 7 3 8 4 3 2	42	

The stools were dug at regular intervals of 15 feet. It will be seen that the infestation of the S.J. 4 was actually heavier than that of the Clark's Seedling, a circumstance which might be expected owing to the S.J. 4 being the taller cane and hence more attractive to the flighting beetles.

This resistance of S.J. 4 appears to be due to its greater capacity to regenerate roots. The importance of such resistance is twofold : not only does S.J. 4 appear to be able to withstand a somewhat heavier grub attack than the other standard varieties but, in the event of infestation being such as to render fumigation necessary, the S.J. 4 will remain erect for a longer period and thus permit of fumigation being carried out at a later period. This quality is of particular importance in a season such as 1934 when prolonged rains prevented fumigation until late April.

The Beetle Borer (*Rhabdocnemis obscurus*).

This pest has assumed an importance considerably greater than usual during the past season, and this may be attributed to the following causes :—(1) The large amount of fermenting cane present in the canefields due to (*a*) severe rat damage ; (*b*) grub damage causing over-maturity ; (*c*) flood and cyclone damage, which in addition caused the cane to lodge badly ; and (*d*) to a minor extent top rot and crowding out. (2) The continued wet weather was directly favourable for borer development and, in addition, caused the leaf sheaths to cling together and provided adequate shelter for the adult beetle. These adhering leaf sheaths also almost completely excluded the Tachinid fly larvæ from parasitising the borer grubs, and the adverse weather conditions, by promoting the development of fungus disease, further decimated the Tachinid fly population.

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Borer damage has been particularly severe along the banks of the Mulgrave River, and also in the grub-infested areas of the Little Mulgrave. In Goondi areas, it has attacked Pompey as well as its more favoured variety Badila, whilst in South Johnstone Tachinid flies have not kept the pest under efficient control. In Tully, Ingham, and Proserpine areas the pest is increasing in sufficient numbers to be causing some concern, and steps are being taken to minimise its destructive tendencies.

In the Mackay district this borer was more prevalent than usual, but damage was mostly light. Weekly inspections of trucks in the Farleigh and Racecourse Mill yards show that this pest is present on a number of farms in the North Coast district and on the hills around Farleigh, but damage of any considerable degree appears to be confined to standover Badila.

The Tachinid Fly Parasite.

In the past it has not proved practicable to investigate the economic status of this parasite and conclusions have been rather of an empirical nature. Accordingly it has been deemed advisable to initiate a series of investigations designed to furnish more precise information regarding the limitations of this particular method of control of the beetle borer. As a

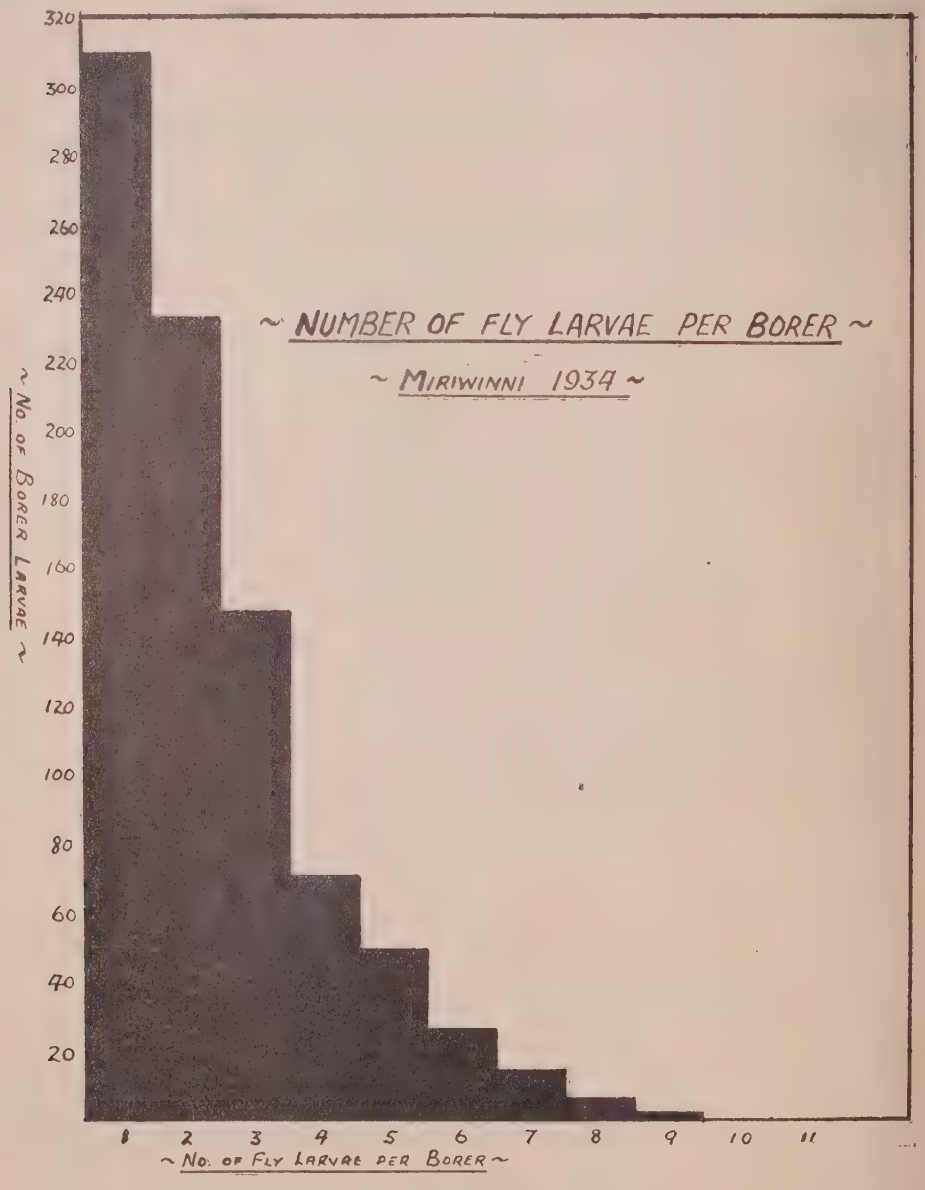

FIGURE 4.

fundamental necessity steps will be taken to determine, by means of population counts, the maximum degree of control which is likely to be effected under optimum climatic conditions and, conversely, the minimum intensity of borer population necessary for the establishment of the parasite.

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Field evidence indicates that a decided check operates on the natural increase of the Tachinid fly during the heavy wet season rains (probably on account of fungus attack) and consequently it appears likely that liberations of flies will have to be made in certain areas every two or three years owing to practically all of the cane being harvested during the season in North Queensland, and there being no tall cane (apart from fly sanctuaries which sometimes are accidentally burnt) remaining. This is in marked contrast to the conditions obtaining in other parts of the world where this borer pest is found, where cane in all different sizes of growth is found on the same farms or plantations. Consequently the borer always has plenty of well-developed cane in which it can operate, and therefore the Tachinid fly always has a sufficient number of hosts on which it can permanently maintain itself, once it has become effectively established in that particular locality.

During the past season the breeding of Tachinid flies has been carried out on a much larger scale than heretofore and since the beginning of July liberations have been made in the borer-infested canefields of the far North at the rate of 2,500-3,000 flies per month. In view of the heavy check on natural increase during the rainy season, mentioned above, it is probable that late-season liberations are of little value in getting the parasite effectively established. Certainly in cases where late liberations were made last year it has not been possible to recover the parasite during the past few months, and accordingly an effort has been made to make earlier and larger liberations this year. By checking up on subsequent recoveries it will be possible to determine the best time and the most economical number of flies to liberate over a given area.

In carrying out this programme of fly-breeding, the method of breeding the flies in cages has been abandoned and the method of collecting puparia from borer-infested cane in the field has been substituted. These puparia are sent to the Meringa Laboratory, where the flies are bred and forwarded to the various centres requiring them. Not only are fly puparia taken in the field, but it has been determined that borer larvæ found adjacent to fly puparia in a stick of cane almost always contain parasite maggots. Accordingly these borers are boxed in salve tins with a small piece of cane and sent to the laboratory, where they are examined from 1-2 weeks later, when the majority will have yielded fly puparia which are similarly bred to the adult stage. In Fig. 4 are recorded graphically the numbers of puparia obtained from each parasitised borer, up to September 15th, the average number obtained being 2·45 fly puparia per borer larva. In addition to this field collection of puparia and parasitised borer larvæ, it is possible, on cloudy days or during periods when light showers alternate with periods of sunshine, for one man to collect in the field during the few hours near midday from 80 to 150 flies, and when weather conditions have been favourable full advantage has been taken of this circumstance. The advantage of such collections lies in the fact that practically all of these flies have mated and a large proportion are ready to parasitise borers the moment they are liberated in new areas. During dry windy periods flies are seldom seen, and no attempt is then made to collect them.

Trapping of Beetle Borers.

In order to obtain definite data on the value of trapping as a subsidiary control measure for weevil borers, split cane traps have been laid out at Miriwinni in a block of standover Badila; these are regularly visited and counts of the captured borers made. The number of beetles obtained at each examination of these traps since the 3rd of July is shown graphically in Fig. 5, and it is probable that later some correlation will be obtained between the daily rainfall and the number of beetles caught, it already being apparent that during showery weather considerably more beetles fly to the traps.

The traps used in this work consist of cane sticks twelve to fifteen inches in length, split lengthwise and laid face down in three or four layers, the first layer being on the soil and each layer consisting of four or five pieces of cane. The traps are located at short distances from the headland in the inter-rows of the block of cane and are examined at intervals of one to three days. Experiments have been tried with half the traps lightly covered with trash and the other half left open, the former proving slightly more effective. Traps aged from one to forty-three days have been used, the age being calculated from the time of splitting to the day of examination. Up to thirty days the age of the trap had little effect on the numbers of borers caught, but after thirty days the attractiveness of the bait fell off very quickly, and by forty days only odd beetles were attracted. Preliminary experiments, using fresh and sour cane, seem to indicate that the sour cane traps are more attractive to the beetles.

The total number of borers captured between 3rd July and 8th September, using six traps, was 1,455, the greatest catch in a single trap at one examination being 59 borers.

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Losses from Borer Attack.

In order to gain some idea of the losses attendant upon borer injury, a truck of borer-infested Badila cane was unloaded and, care being taken to exclude all rat-damaged cane, sticks from a portion of the truck were sectioned and placed into various classes representing various degrees of borer damage. These sectioned sticks were then crushed and the juices analysed.

Degree of noticeable damage.	Per cent. Joints bored.	Corrected Brix.	Pol.	Purity.	C.C.S.
Nil	0	23·3	20·90	94	17·1
Light	11	19·9	17·58	88	13·9
Moderate	29	19·0	16·65	88	13·1
Bad	42	12·9	8·87	69	5·8
Very bad	81	8·3	4·20	51	2·3

These results emphasise in no small way the losses that growers are likely to experience where borers are prevalent. It also demonstrates rather forcibly the necessity for the application of subsidiary measures in borer control rather than to rely solely on the activities of the Tachinid

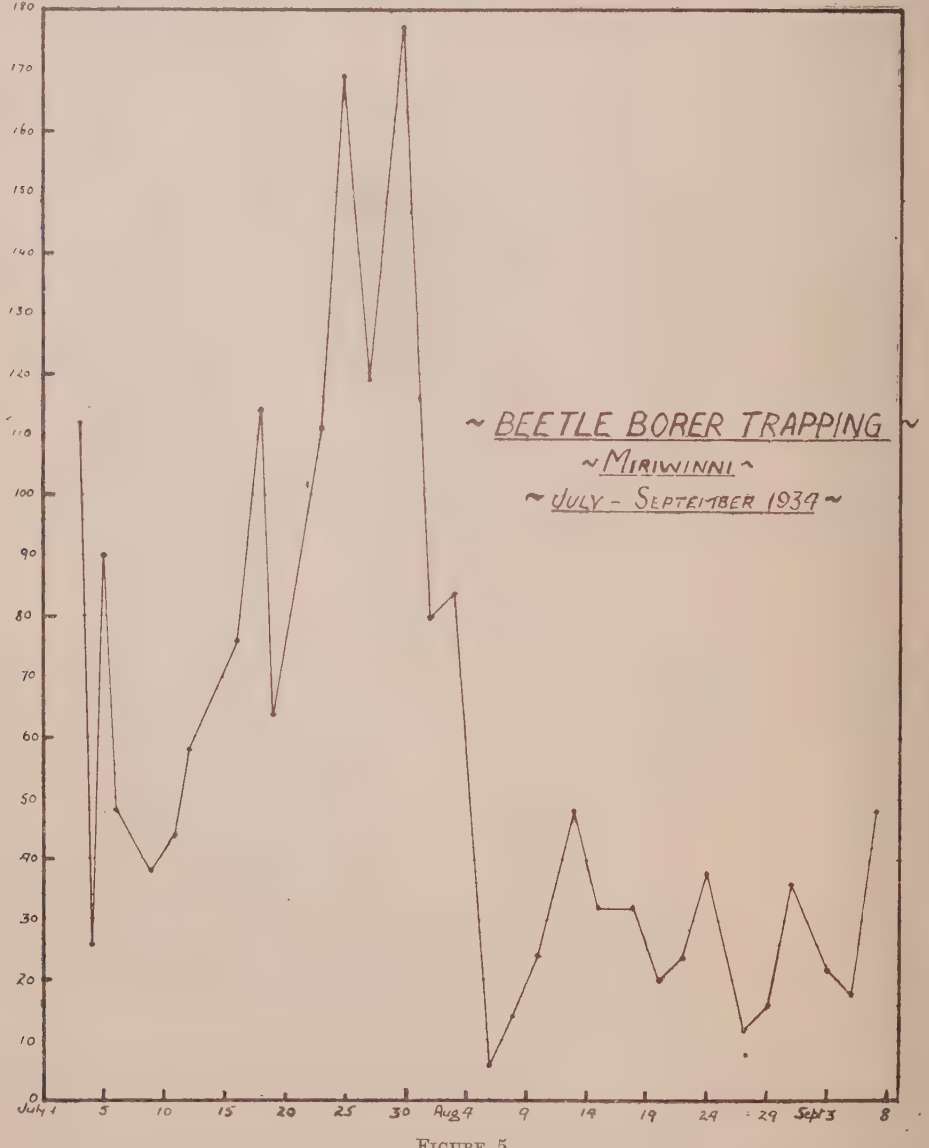

FIGURE 5.

fly. One of the apparent weaknesses in leaving small areas of standover cane as fly sanctuaries is the inevitable migration of beetles from these plots to surrounding cane paddocks, and the outskirts of such small areas should be systematically trapped to interrupt migrating beetles.

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Resistance of S.J. 4 to Beetle Borer Attack.

Attention has already been drawn to the resistance of S.J. 4 to cane grub attack, but it is apparent that its usefulness is not confined solely to resistance in this respect, as it will likewise withstand borer attack better than some of the standard varieties. In contiguous fields where S.J. 4 and Badila were growing under similar conditions, Badila showed an average infestation of 23·13 per cent., whilst the infestation in S.J. 4 amounted to only 4.25 per cent. It is thought that such resistance is due to a combination of such factors as the possession of a harder rind and a tendency towards late maturity.

Miscellaneous.

Bud Moth (*Opogona glycyphaga*).

Some concern was caused in the Mulgrave area during the recent planting season as a result of the activities of the Bud Moth, *Opogona glycyphaga*, and some fields of cane were abandoned as a source of plants owing to its activities. It is probable, however, that its importance was grossly exaggerated, as in all cases where bad "strikes" were reported, they were found to have resulted through planting in a comparatively cold wet month such as June proved to be, and from the use of very succulent planting material, which rotted in the ground. Tallies of damaged buds in fields of S.J. 4 where the damage was reported to be worst showed an infestation of 7·2 per cent. of the total eyes. As in only a few cases were consecutive eyes eaten, it is probable that the losses from this pest were not more than 1-2 per cent., and therefore of minor importance only in areas such as these where the plants are distributed fairly thickly in the drills.

Stratiomyid Fly (*Metoponia rubriceps*).

A serious outbreak of this pest occurred at Fairymead, in the Bundaberg district, during the past year, and as a consequence several fields of cane failed to ratoon. Mr. Mungomery states that during the past eight years this pest has not been known to infest more than a few small patches of cane land, and its occurrence during the past year over this larger area is abnormal, being due in all probability to the usually wet conditions obtaining during the winter and spring months of last year. In normal years it is considered that a heavy mortality takes place in the egg and early larval stages through desiccation, but such would not occur during the past season, with the result that infestation became severe. It does not appear possible to control the insect easily during the adult stage, and tentative suggestions include the ploughing and thorough tilling of infested land during the prepupal and pupal stages, and as soon as the adults emerge every effort should be made to maintain a dry surface mulch. Irrigation should be practised with extreme caution, as this may increase the early larval survival. Another factor which would probably afford some relief would be to try to arrange the farming programme so that all blocks adjacent to infested areas should be in a similar state of cropping. With the present method of having a young plant crop adjacent to an old infested ratoon crop, it is apparent that the former will suffer infestation through migration of the flies from the latter block, and in this way a dense fly population will be maintained yearly.

The Large Moth Borer (*Phragmatiphila truncata*).

The presence of this insect was noticeable in many fields in the Mackay district, and reports as to the presence of the beetle borer were frequently found to be due to the moth borer. In view of the scanty knowledge of many important phases of the life and activities of this pest a study of its life history is being undertaken in Mackay. An examination of 189 pupæ collected from fields during August did not reveal the presence of any parasites; of 253 larvæ collected in the field, five were parasitised by *Apanteles nonagriæ* Oll.

The damage caused by this pest in growing cane is usually greatly exaggerated, an infestation severe enough to cause a weak stand of cane being a rarity, and to a great extent the borer merely effects a thinning-out which would otherwise take place through death due to overcrowding. The borer also attacks standing cane, but a detailed investigation of the worst attack reported indicated that the damage was mainly confined to a border of about one chain wide around the headlands; a careful analysis indicated that the total loss amounted to less than one half-penny per ton.

Division of Entomology and Pathology—continued.

Wireworms.

In the Mackay district a few strikes only were damaged by wireworms and were confined to very low corners or depressions in fields in several localities. The investigation of the incidence of this pest and its control has now been concluded by Mr. McDougall. A paper dealing with methods for determination of the larval instars and stadia of the important wireworms was published during the year, and a paper dealing with practical aspects of the problem is now in press.

Rat Damage.

Damage to cane on account of the attack by rats has been considerably greater than in previous years and in the aggregate has been greater than that caused by any other pest. Some assistance has been rendered by the Entomologists in the matter of advice as to methods of trapping and baiting. It must be emphasised, however, that the position in regard to the control of this particular pest is unsatisfactory and calls for review by a Zoologist with specialised knowledge of these animals. Much more requires to be known regarding their numbers and habits in the cane areas before control campaigns can be placed on a rational basis, and the actual effect of baiting, trapping, &c., should be determined statistically and not left a matter for conjecture.

Division of Mill Technology.

Mr. E. R. Behne, Assistant Technologist.

Introduction.

Since the last Annual Report, Mr. D. L. McBryde has joined the staff as Assistant Technologist, and in addition the services of Mr. C. Peel have been available for the calculation and clerical work in connection with the Mutual Control.

Laboratory Work.

The work undertaken in the laboratory during the last slack season, was confined to an investigation into the calorific value of bagasse, the glass electrode and the standardisation of apparatus.

Calorific Value of Bagasse.

In order to verify the assumption that, thermally, Queensland bagasse does not differ appreciably from that of other countries, samples were taken of bagasse resulting from the crushing of cane of different varieties and of varying physical conditions, and the thermal values determined. The calorific values were expressed as gross values, i.e., the total quantity of heat that can be obtained when the products of combustion are reduced back to the initial temperature. The results obtained are given in the following table :—

Table I.—Calorific Values of Bagasse from Different Sources.

Cane.				Bagasse.			
Variety.	Crop.	Condition.	Fibre.	Pol, Dry Basis.	Ash, Dry Basis.	Calorific Value B.T.U.'s per pound.	
						Dry Basis.	Dry Ash-free Basis.
			%	%	%		
B. 208	Plant ..	Green ..	11·83	8·49	1·86	8,208	8,363
H.Q. 426 ..	Plant ..	Green ..	10·50	6·19	1·93	8,243	8,405
E.K. 28 ..	Plant ..	Green ..	12·19	7·00	2·33	8,164	8,360
Badila	Plant ..	Green ..	9·16	7·29	4·21	8,092	8,447
M. 1900 ..	Plant ..	Green ..	14·00	6·60	2·57	8,142	8,357
H.Q. 285 ..	Ratoon ..	Burnt ..	13·50	5·79	2·57	8,187	8,404
Co. 210 ..	Ratoon ..	Burnt ..	20·00	5·42	2·20	8,214	8,399
Q. 813	Ratoon ..	Burnt ..	14·50	5·89	2·43	8,198	8,402
Black Innes ..	Ratoon ..	Burnt ..	14·00	4·51	2·40	8,231	8,433
P.O.J. 213 ..	Ratoon ..	Burnt ..	13·50	5·79	1·93	8,144	8,304
D. 1135 ..	Ratoon ..	Burnt ..	15·50	5·32	3·37	8,126	8,409
Average				6·21	2·53	8,177	8,389

The determinations cover a wide range of conditions but the calorific value for the dry ash-free content remains substantially constant ; the differences on the dry basis are, therefore, due to the variation in the ash content. As a result of these determinations the calorific value of bagasse is 8,200 B.T.U's. per pound of dry substance and 8,400 per pound of dry ash-free substance.

In addition, determinations were made on four samples of bagasse which were considered to be abnormal in certain respects. The results are given in Table II.

TABLE II.—Calorific Values of Four Samples of Apparently Abnormal Bagasse.

Calorific Value.		Ash per cent., Dry Basis.	Remarks.
Dry Basis.	Dry, Ash-free Basis.		
8,193	8,424	2·74	Cane grown under swampy conditions
8,020	8,374	4·23	Bagasse allowed to ferment for several months
8,292	8,384	1·10	From dump in yard ; least deteriorated part
8,031	8,302	3·26	From dump in yard ; most deteriorated part, probably contaminated with molasses.

In no way do these samples differ markedly from those in Table I.

Attention should here be drawn to the fact that although the values given above for the different types of bagasse are substantially constant, it does not mean that all would give equal practical results in the furnace. It has often been noted by mill engineers that whenever a certain

Division of Mill Technology—continued.

variety of cane is passing through the mill, great trouble is experienced at the boiler station. In some cases this may be traced to excessive moisture in the bagasse, but it is quite possible that the physical nature of the fibre may have a bearing on the question.

The Glass Electrode.

This work was only of a preliminary nature to determine whether the apparatus was suitable for practical routine determinations. Encouraging results were obtained, but time did not permit of carrying the project any further. The valve circuit used was somewhat complicated and cumbersome, but it is hoped to simplify it considerably in the future.

Standardisation of Apparatus.

Brix Spindles.—Two hundred and sixty-seven spindles were tested and official certificates were issued for all but fifty-eight, of which forty were of odd ranges and the remaining eighteen had corrections outside the tolerance.

Polariscope tubes.—Fourteen were tested and all were satisfactory.

Flasks.—Seventy-three flasks were checked and fifty-three were within the tolerance required.

Pipettes and Burettes.—Thirty pipettes and burettes were tested and twenty-five were satisfactory.

Thermometers.—Three thermometers were tested.

Weights.—Three sets were checked.

Polariscopes.—Three instruments were cleaned and checked.

Mutual Control.

One more mill joined the Control this season making a total of twenty-three mills supplying figures for comparison. The data and calculation sheets were revised and enlarged to include additional items resulting in a more detailed comparative sheet. A fortnightly average book was instituted in order that the position of each mill may be obtained at any time.

The Second Annual Synopsis was completed and forwarded to those mills in the Control.

The Laboratory Manual for Queensland Sugar Mills was completed and issued early in the crushing season. To date 280 copies have been disposed of.

Mill Investigations.

At the close of the 1933 season work was carried out at the Babinda Mill on the question of subsider capacity. As a result of this investigation the efficiency of subsidation (expressed in terms of the percentage of mud carried over in the clarified juice) was correlated with the depth of clear juice in the subsider. The results are shown graphically in Fig. 6 from which it is evident

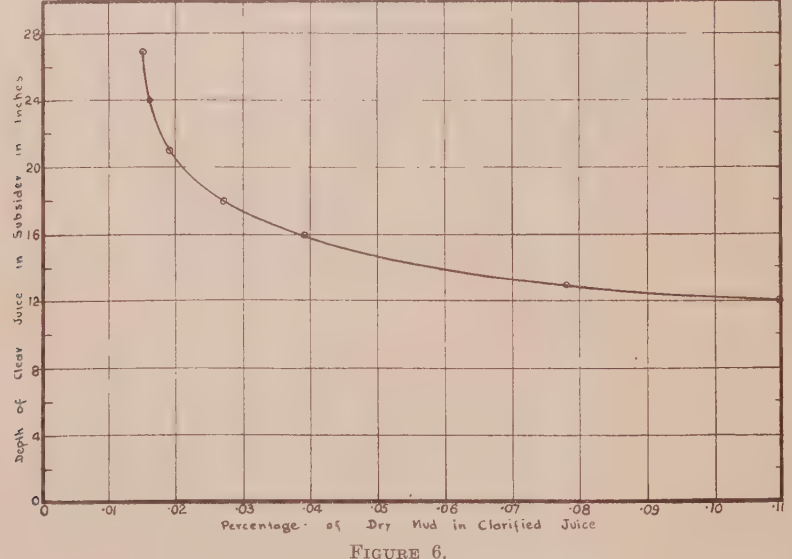

FIGURE 6.

that, in this experiment, if the depth be maintained above twenty inches the quantity of mud carried over will be negligible. It is also evident that a small reduction in this depth is accompanied by a disproportionately large increase in the quantity of mud carried over. The curve is asymptotic at $y=9$, i.e., when the depth of clear juice is 9 inches all the mud would be expected to come over.

Division of Mill Technology—continued.

At Tully the installation of the Automatic Liming Control was continued. The automatic weir was installed but placed in manual operation only, as the filtering problem was not solved sufficiently for connecting up with the recorder. In order to filter the juice, various media and types of filter were tried. At one stage wood wool appeared satisfactory but, unfortunately, it had a considerable lowering effect on the pH of the juice. This effect was investigated in the laboratory giving the following results. The pH of clarified juice containing wood wool was observed at intervals up to 170 minutes, the temperature was maintained at 80°C. in a water bath.

Time in Minutes.	pH Blank Solution.	pH Treated Solution.	Difference due to Wood Wool.
0	6·91	6·91	..
30	6·91	6·78	·13
60	6·89	6·71	·18
90	6·87	6·61	·26
120	6·85	6·58	·27
170	6·77	6·52	·25

During the investigation the following media were tried :—Cotton waste, filter cloth, filter paper, wood wool, silk, fine gauze, steel wool, sand, coke, and finally, fine bagasse. Of all these the most satisfactory proved to be the last—fine bagasse. It then became apparent, however, than an intermittent filter was unsatisfactory in that it required frequent changing. Consequently a continuous type of filter has been designed using fine bagasse as the medium. This filter has not yet been completed, but it is hoped that before the present season is finished it will be in operation.

In connection with this automatic liming device two visits were paid to the Colonial Sugar Refining Company's Mill at Condong, where such a device is in practical operation. The system adopted at this mill is different from that attempted at Tully so that although a considerable amount of information was obtained the solution of the main problem of filtering the juice was not effected.

At Babinda Mill this season, a system of sugar control was instituted. Weekly samples of sugar were obtained from the mills in the Northern district and physical tests were made thereon to determine grain size and filterability. The results were forwarded to the mills in the form of a comparative sheet. At the same time sugar boiling methods were investigated. The means of carrying out this programme were due to the courtesy of the Babinda Mill. In the Bundaberg area a similar scheme was operated through the courtesy of the Bingera Mill.

Until two years ago the physical quality of the raw sugar turned out by the Queensland mills received scant attention. During the last two years, however, the need for considerable improvement in this connection has been stressed in various quarters and it is pleasing to note that all mills have gone to considerable pains to affect improvements. In some cases the achievements have been remarkable whilst in others only small improvements have been made. Filterability is the main problem, with grain size in the second place. For sugar of good filtering quality, efficient clarification and subsidation are essential, but are by no means all. The effect of good clarification can be completely nullified by poor pan stage operations. At several mills the conductivity method of sugar boiling has been an invaluable aid, and it is at these mills that the greatest improvements have been made ; it is stated that it would be impossible to maintain this high standard without the assistance of the apparatus. Other mills have realized the inadequacy of their plant and have made additions necessary to cope with the extra work placed on the pan stage. It is contended that the work at the pans will be reduced when an even-grain size sugar is made. In other words, an increased output rate may be expected when old-style methods have been modified to permit of clean boiling. Not only do pans boil more rapidly on well-balanced feed, but the shipment massecuites also yield molasses of lower purity. Any changes at the present time, other than on pan stations which are chronically weak and out of balance with the rest of the factory, should be limited to such items as the fitting of continuous feed valves, star-feed system, alterations and improvements to the vacuum service where such is faulty (as in the case of common vacuum main or single condenser), the re-setting of coils, &c., where any of these factors is in need of attention.

In general, the season may be looked on as one of reconstruction in which the various mills have experimented along different lines all with the aim of improving the quality of the sugar. At Mulgrave Mill an experiment was carried out to determine the effect of adding supercel

Division of Mill Technology—continued.

to the mixed limed juice. The supercel was added with the milk of lime at the rate of 2 oz. per ton of cane. The first application was made over a period of three days and although no conclusive results could be obtained, it is notable that the mill figures over that period were somewhat better than they had been previously. In order to test whether this improvement was merely an accidental coincidence or was due to the addition of the supercel a second run was made for a period of one week. The results of this run, however, were negative, in that there was no apparent difference in any department of the mill resulting from the addition of the supercel. A further and more comprehensive test may be carried out in this respect next season.

*Notes on Sugar Boiling and Sugar Quality in Queensland.

Generally speaking, the importance of perfect clarification has received insufficient attention, particularly during recent years when notable advances have been made in increased milling efficiency. A careful study of this aspect of the process is essential before it can be claimed that it is ideally controlled.

The difficulties are great and it would seem that the Central and Southern district mills have a more complicated problem than those in the North. It is felt, also, that a near approach to perfection will not be realised by any mill until automatic liming control, according to the exact requirements of the juice, is made possible. Certain mills are operating with a shortage of subsider capacity; others possess well balanced capacity with normal cane juices only, and when dealing with juices from refractory cane the capacity is all too little for the work. In such cases, the only procedure to prevent muddy juices is to reduce the lime, and by reducing the quantity of precipitated mud, a sediment-free juice is obtained. Such juice is only partially defecated, and yields sugars of poor filterability as compared with sugars from the completely clarified juice.

As regards the control of crystal formation and growth during the process of sugar boiling, much remains to be understood. In most cases, several obstructions were found, each of which was sufficient to destroy the possibility of satisfactory control of the process; these may be enumerated as follows:—

(1) *Pan-work Control by Observations with the Unaided Eye.*—It is necessary to have some means of detecting more than can be seen with the naked eye; otherwise it is not possible to observe the presence of unwanted crops of crystals (false grain) at the moment they occur, or even when such crops are equal in number to that of the original crop of crystals. With the microscope, employing a magnification of 20 to 25, not only is it possible to detect the presence of the false grain, but such crops are seen when the crystal is about one quarter of the size at which they are detectable by the unaided eye. In practice, these fine crystals are usually present to the extent of at least ten to one of the original crystals before the massecuite would be considered " dirty " under the older standard of boiling sugar.

Massecuites boiled without microscopic control are usually found to be of very mixed grain sizes because of the unsuspected periodic graining during the course of boiling, particularly if heavy density feed and intermittent " drinks " are the standard practice.

(2) *Intermittent Feed.*—This method of boiling is the cause of the formation of undesirable crystals during process; when a massecuite is " heavied " sufficiently to be in need of a " drink," the mother liquor is generally supersaturated to such a degree that spontaneous graining has occurred, and when such heavy material is given a drink, a further " shock " crop usually forms. These happenings are avoidable only when the attendant is particularly attentive and adopts the habit of giving frequent small drinks.

A point well worthy of consideration is that the ideal degree of supersaturation of mother liquor for the maximum rate of crystal growth is decidedly lower than the degree of supersaturation at which spontaneous crystal formation occurs; and therefore the ideal method of sugar boiling is to maintain the supersaturation within those limits which provide for maximum crystal growth while preventing grain formation. Such a state can be held only with a continuous feed to the pan.

(3) *Heavy Density Feed Molasses.*—There are several objectionable points to the feeding of undiluted molasses to the pan, as enumerated below:—

(*a*) Heavy feed materials invariably carry sugar crystals, which cause mixed grain size in the finished sugar.

(*b*) It gives rise to poor exhaustion because of the inability to " boil on " the material at the rate at which it is necessary to feed the pan in order to keep the massecuite at a reasonable boiling weight.

*Prepared by Mr. D. L. McBryde, Assistant Technologist.

Division of Mill Technology—continued.

(*c*) It causes serious molasses inclusion because it is usual to keep the mother liquor at a high density in order to prevent the massecuite from becoming " sloppy." The minimum dilution should be that at which the feed provides for the rate at which the crystal crop can exhaust the material in the feed ; and at the same time, the water in the feed should balance the rate of evaporation by the pan. An alternative method is the use of movement water ; but in all cases, there should be sufficient dilution of feed material to ensure that it does not carry grain to the pan.

(4) *Faulty Circulation.*—Some pans were found to have very poor circulation. Such pans are potent sources of poor quality sugar and the grain is usually of a very mixed and damaged character. In such cases, nothing short of internal re-arrangement to permit of efficient circulation is necessary. In other instances, circulation was prevented by faulty boiling practice, and the trouble was frequently remedied by modification of methods. Intermittent feeding is a great cause of interference, as the flow is killed each time the pan becomes heavy. In these instances the big "drink" mixed in slowly and a considerable period elapsed before circulation recommenced ; during the dead period, much damage to grain usually occurred.

Star-feed and continuous feed are the best methods for keeping a pan in its best state of circulation, but are not sufficient to correct a mechanically-faulty pan. Poor circulation, whether due to the nature of the pan or faulty boiling methods, is in the writer's opinion responsible for all formation of conglomerated grain which occurs during the process of sugar boiling. This is brought about by such excessive heating of the massecuite film, which remains for an unduly long period in contact with the heating surfaces, that the mother liquor becomes unsaturated and is capable of eroding grain. When such grain is removed from contact with the heating surface, it loses its superheated, unsaturated state, and all crystals in contact join instantly in conglomerated masses.

(5) *Irregular Vacuum and Steam Supply.*—These two sources of trouble often go hand in hand. A sudden fall in steam pressure will give a reaction of a quick rise in vacuum, often resulting in a plentiful crop of false grain. Other vacuum changes, due to faulty mechanical gear for example, cause false grain crops, if there is a sudden rise, or killing of circulation if there is a fall. Where possible, the gear should be so arranged that there is no interference with any pan during the course of boiling ; this is particularly desirable with seed pans.

With further reference to the matter of conglomerate formation, it should be stated that a further amount is formed as a result of " inside " steaming in the fugals. The amount of conglomerate here formed will be found to increase very appreciably with sugars of mixed grain size, particularly if the massecuites are at all " dirty " when dried. This appears to be due to the excessive steaming, and heating, which is necessary to turn out a shipment sugar of the required pol, when badly-drying massecuites are treated.

It must be stated that the Executive staffs of the Queensland mills are fully seized with the importance of improving the physical quality of their sugars, if the exported surplus is to compete with sugars of foreign manufacture. Managers and chemists were most anxious to improve their product, and the reception which was afforded the writer must be taken as an indication of a desire to gain as much information as possible on this important subject. It is regretted that the limitations of time prevented more extensive studies at each of the mills visited.

A most pleasing aspect of the project was the enthusiasm displayed by the sugar-boiler in his attempt to meet the requirements of the new sugar standard. It must be remembered that the Executive officers of the industry have accepted the old standard of sugar from these men for many years past, without complaint regarding its physical shortcomings, and have thereby encouraged fixed habits and methods in our boilers. It speaks well of the sugar-boiler to say that he is anxious to modify these lifetime methods when he is shown their bad effect on the quality of the sugar. This can only be done, incidentally, with the assistance of the microscope.

There appears to be no necessity for changes of a revolutionary nature to enable these improvements to be brought about. Certainly the introduction of mechanical aids in the form of conductivity or temperature-difference instruments is new to Queensland practice. The former type, usually referred to as the " Cuitometer," has proven entirely capable of indicating the state of the pan contents under all conditions of work, and it would seem that these will be fitted to all pans in the near future. The other, the temperature difference recorder, is no doubt the better instrument, in theory ; but so far its use has not been developed to the point where it provides the satisfactory control afforded by the alternative instrument, at least under Queensland conditions.

Division of Mill Technology—continued.

Another novel feature is that of seeding with icing sugar instead of graining. It is necessary to have mechanical control so that the material in the pans is kept out of the " graining " zone before this can be successfully accomplished. In one mill the seeding method was introduced with success by means of the string-proof ; but nice control with this proof only lasted over the period taken to establish the seed crop, and once the material was boiled to a sugary form, on movement water, it became impossible to carry the control further. This early part of the process is, however, the most important phase, and when the uniform foundation was established, it was possible to turn out C massecuites of a uniform size.

It appears likely that seeding will supersede graining in the near future, and that a much finer control will be effected by the modification. It must be understood that the rather common method of using a small quantity of castor or icing sugar to induce or " shock in " a crop of natural grain differs entirely in principle from the method outlined, as in this case the pan is boiled to a degree of supersaturation where spontaneous crystal formation is possible ; whereas, with true seeding, a spontaneous crop of crystals is not possible, and the supersaturation of the material is only sufficient to hold and grow the sugar particles added to it.

Mill Work for Season 1933.

The 1933 season was notable for exceptionally high tonnages of cane, in the Northern and Central districts, whilst after a very lean year in the Southern district a return to practically normal conditions was made. This resulted in a record crop for Queensland, and although the average quality of the cane was inferior to that of previous years, a record quantity of sugar was produced. These high figures naturally brought about increased crushing rates and prolonged crushings in the Northern and Central districts. In the Southern district the crushing rates were also increased. The average increase amounted to about 10 per cent. on the previous year. The crushing rates quoted in last year's report are the " weighted " averages which are incorrect in that the average rate so obtained is greatly influenced by the mills with large tonnages. The arithmetic mean gives a true state of affairs. Furthermore, complete data in this respect was not available for previous reports, so that it is not possible clearly to show this increase. For instance, whilst the 1933 rate includes all mills (except C.S.R., Pioneer, and Inkerman), the previous ones do not include such mills as Eagleby and Rocky Point. Then in addition, in 1932 several small mills in the Bundaberg district did not crush. Because of this, the crushing rates in previous years has not been included in these comparisons.

The inferior quality of the cane of the 1933 season was due practically entirely to seasonal influences. A very mild, wet crushing season resulted in considerable crop growth during harvesting, which also prolonged the season, and resulted in a considerable quantity of immature and overripe cane being crushed. During the last four years (with the exception of the Southern district) there has been a gradual decrease in the sugar content of the cane. This is clearly shown in the following Table :—

		Pol in Cane.	Fibre in Cane.	Purity, First Exp. Juice.
		%	%	
Southern district	1930	14·58	15·00	89·91
	1931	15·01	15·40	88·25
	1932	13·32	15·16	84·95
	1933	13·55	15·21	87·65
Central District	1930	16·80	13·06	91·70
	1931	16·73	12·42	89·93
	1932	16·22	11·99	90·02
	1933	15·40	12·25	90·84
Northern District	1930	15·98	11·38	90·77
	1931	15·56	10·61	89·94
	1932	16·07	10·51	90·11
	1933	14·92	10·27	88·84
All Districts ..	1930	15·97	12·59	90·90
	1931	15·94	12·28	89·59
	1932	15·90	11·51	89·64
	1933	14·85	12·00	89·40

Division of Mill Technology—continued.

This table shows that the 1933 season was well below the previous three seasons as regards sugar content of cane. This naturally is reflected in the sugar yield—the tons of cane per ton of 94 n.t. sugar being considerably higher than in the previous five years.

—	1928.	1929.	1930	1931.	1932.	1933.
Tons cane per ton 94 n.t. sugar.	7·18	6·91	6·83	6·94	6·90	7·31

The average for the ten years prior to 1933 is 7·25.

The standard of work has been maintained, with slight variations, in all departments as is indicated in the following tables. In the Central and Northern districts there has been an improvement in the mill work and in spite of the slight set back due to bad conditions still prevailing to some extent in the south, resulting in slightly poorer work in this district, the figures for all districts show a definite improvement.

SOUTHERN DISTRICT.

—	1930.	1931.	1932.	1933.
Tons of cane	647,794	691,247	208,591	659,393
Tons of 94 n.t. sugar	84,114	91,546	23,747	77,229
Tons of cane per ton 94 n.t. sugar	7·72	7·551	8·784	8·538
Pol in cane	14·58	15·01	13·32	13·55
Fibre in cane	15·00	15·40	15·16	15·21
Purity—				
First expressed juice	89·91	88·25	84·95	87·65
Clarified juice	89·00	87·77	83·87	86·88
Syrup	88·51	87·37	83·59	87·38
Gallons molasses per ton cane	4·66	4·73	5·97	4·95
Apparent purity final molasses	..	40·90	39·06	40·96
Overall recovery	85·32	85·13	81·62	83·63
Recovery on mixed juice	90·42	90·45	87·42	89·74
Boiling house efficiency	94·67	95·54	94·09	95·11

CENTRAL DISTRICT.

—	1930.	1931.	1932.	1933.
Tons of cane	1,155,912	1,265,744	1,283,821	1,737,205
Tons of 94 n.t. sugar	176,619	189,440	190,995	249,680
Tons of cane per ton 94 n.t. sugar	6·53	6·682	6·722	6·958
Pol in cane	16·80	16·73	16·22	15·40
Fibre in cane	13·06	12·42	11·99	12·25
Purity—				
First expressed juice	91·70	89·93	90·02	90·84
Clarified juice	91·30	88·88	89·38	90·47
Syrup	91·60	89·20	89·52	90·52
Gallons molasses per ton cane	3·61	4·65	4·60	4·08
Apparent purity final molasses	40·52	40·45	39·50	40·28
Overall recovery	86·69	85·35	86·56	87·44
Recovery on mixed juice	92·23	91·35	91·77	92·38
Boiling house efficiency	95·69	95·63	96·02	96·26

Division of Mill Technology—continued.

NORTHERN DISTRICT.

——	1930.	1931.	1932.	1933.
Tons of cane	1,717,999	2,078,138	2,054,031	2,270,430
Tons of 94 n.t. sugar	254,537	300,289	299,343	311,825
Tons of cane per ton 94 n.t. sugar ..	6·75	6·920	6·862	7·281
Pol in cane	15·98	15·56	16·07	14·92
Fibre in cane	11·38	10·61	10·51	10·27
Purity—				
First expressed juice	90·77	89·94	90·11	88·84
Clarified juice	90·59	89·74	89·63	89·19
Syrup	90·77	90·02	90·30	89·23
Gallons molasses per ton cane ..	3·39	3·61	3·63	3·65
Apparent purity final molasses ..	39·55	35·33	37·33	35·21
Overall recovery	87·63	87·67	87·85	87·94
Recovery on mixed juice	92·22	92·40	92·43	92·71
Boiling house efficiency	96·13	96·72	96·67	97·60

ALL QUEENSLAND DISTRICTS.

——	1930.	1931.	1932.	1933.
Tons cane	3,521,705	4,035,129	3,546,443	4,667,028
Tons of 94 n.t. sugar	515,270	581,276	514,085	638,734
Tons of cane per ton 94 n.t. sugar ..	6·84	6·942	6·885	7·307
Pol in cane	15·97	15·94	15·90	14·85
Fibre in cane	12·59	12·28	11·51	12·00
Purity—				
First expressed juice	90·90	89·59	89·64	89·40
Clarified juice	90·50	89·06	89·15	89·25
Syrup	90·60	89·28	89·42	89·41
Gallons molasses per ton cane ..	3·70	4·18	4·18	4·07
Apparent purity final molasses ..	40·65	39·19	38·31	38·55
Overall recovery	86·83	86·37	86·88	86·76
Recovery on mixed juice	91·89	91·79	91·86	91·88
Boiling house efficiency	95·72	96·27	96·31	96·39
Pol extraction	94·49	94·10	94·58	94·43
C.C.S. in cane	14·957	14·798	14·767	13·76
Coefficient of work	97·82	97·35	98·15	98·31

Division of Mill Technology—continued.

FIGURES FOR 1933 SEASON.

—	Northern.	Central.	Southern.	Totals and Averages.
Tons cane crushed	2,270,430*	1,737,205*	659,393*	4,667,028*
Tons sugar made (94 n.t.)	311,825*	249,680*	77,229*	638,734*
Net titre	97·42*	97·36	97·18	97·35
Tons cane per ton 94 n.t. sugar	7·281*	6·958*	8·538*	7·307*
C.C.S. in cane	13·79	14·43	12·40	13·76
Coefficient of work	99·89	97·90	94·45	98·31
Crushing rate	67·50	46·95	30·29	44·73
Lost time, per cent.	2·49	7·64	9·09	6·48
Fibre, per cent. cane	10·27	12·25	15·21	12·00
Pol, per cent. cane	14·92	15·40	13·55	14·85
First expressed juice—				
Brix	19·82	20·50	19·36	20·00
Purity	88·84	90·84	87·65	89·40
Clarified juice—				
Brix	15·89	15·88	14·09	15·54
Purity	89·19	90·47	86·88	89·25
Syrup—				
Brix	66·53	68·21	67·79	67·43
Purity	89·23	90·52	87·38	89·41
Last expressed juice—				
Purity	78·52	78·77	75·57	78·08
Clarified juice per 100 cane	99·31	100·99	102·74	100·61
Dilution per cent. first expressed juice	24·70	29·09	37·40	28·70
Pol bagasse	3·28	3·04	2·70	3·04
Dry substance	48·08	49·03	48·26	48·50
Pol extraction	94·86	94·65	93·19	94·49
Extraction ratio	·500	·436	·448	·458
Milling loss	7·470	6·730	6·041	6·815
Final molasses—				
Gallons per ton cane	3·65	4·08	4·95	4·07
Brix	83·65	85·32	83·23	84·22
Apparent purity	35·21	40·28	40·96	38·55
True purity	46·78	49·91	47·18	47·92
Reducing sugars	19·37	11·81	10·44	14·95
Tons mud per 100 of cane	2·74	2·41	4·04	2·86
Pol mud	2·82	2·76	1·39	2·41
Sugar—				
Pol	98·69	98·74	98·71	98·71
Reducing sugar	·342	·259	·199	·284
Ash	·186	·225	·268	·216
Moisture	·339	·307	·317	·322

* All mills. Remainder exclusive of C.S.R., Pioneer, and Inkerman Mills.

Division of Mill Technology—continued.

FIGURES FOR 1933 SEASON—*continued.*

—	Northern.	Central.	Southern.	Totals and Averages.
Dilution indicator	34·56	32·21	32·45	33·26
Pol balance—				
Sugar (recovery)	87·94	87·44	83·63	86·76
Bagasse	5·14	5·35	6·81	5·51
Molasses	4·62	5·88	7·95	5·72
Mud	0·52	0·43	0·41	0·46
Undetermined	1·78	0·90	1·20	1·55
Boiling house efficiency	97·60	96·26	95·11	96·39
Fuel—				
B.T.U.'s (1000s) per ton cane—				
Wood	41	173	257	135
Coal	8	45	2	21
Molasses	215	75	1	119
Bagasse	2,066	2,442	3,016	2,396
Total	2,330	2,735	3,276	2,671
Crop days	1,875*	2,006*	1,249*	5,130*

*All mills. Remainder exclusive of C.S.R., Pioneer, and Inkerman Mills.

Although the pol extraction in 1933 is slightly lower than in the previous year, this does not mean that the work is less efficient. In the first place the fibre : pol ratio in the cane is higher for 1933 than for 1932, and secondly, there is an increase in the crushing rate in the 1933 season. The pol and dry substance figures show a definite improvement as is seen in the following table :—

—	1932.	1933.
Fibre : Pol ratio in cane	·725	·806
Pol bagasse	3·26	3·04
Dry substance bagasse	47·84	48·50
Pol extraction	94·58	94·49
Extraction ratio	·471	·458
Milling loss	7·48	6·815

In the boiling house, the work is of high standard, the boiling house efficiency being the highest to date. The recovery (overall), however, is slightly lower than last year. The co-efficient of work is considerably higher than in previous years.

An interesting comparison arises in the fuel used expressed as 1000's B.T.U.'s per ton cane, for the seasons 1932–1933. These are given in the tables below :—

—	Northern.		Central.		Southern.		Total.	
	1932.	1933.	1932.	1933.	1932.	1933.	1932.	1933.
Added fuel ..	272	264	430	293	437	260	351	275
Bagasse	2,113	2,066	2,423	2,442	3,021	3,016	2,317	2,396
Total ..	2,385	2,330	2,853	2,735	3,458	3,276	2,668	2,671

In each district it will be noted there is a definite improvement in the quantity of fuel used, whilst the total for all districts is slightly greater. This apparent anomaly is explained by the fact that in 1933 the Southern district crushed over three times the amount of cane it crushed in 1932 ; consequently in the weighted averages the small district decreases are more than off-set by this effect of the Southern district.

Crushing for the 1933 season was commenced on 30th May and continued till 29th January, 1934. The first mill to start was Hambledon and the last to cease was Kalamia. The maximum harvesting period was 209 days at South Johnstone and the minimum 65 days at Eagleby. Twelve mills did not finish crushing till January, 1934. The total crop days for all mills was 5,130, compared with 3,276 in 1932, and 4,377 in 1931.

Division of Mill Technology—continued.

Cane Milled and Sugar Yields, Season 1933.

Mill.	Tons Cane Crushed.	Tons 94 N.T. Sugar made.	Tons Cane per Ton 94 n.t. Sugar.	
			1933.	1932.
Mossman	137,064	17,586	7·794	6·996
Hambledon	216,479	29,415	7·359	6·954
Mulgrave	239,526	32,149	7·450	7·054
Babinda	260,636	35,511	7·340	6·707
Goondi	192,084	26,224	7·325	6·687
South Johnstone	286,385	39,149	7·315	6·775
Mourilyan	187,527	27,124	6·914	6·471
Tully	302,736	43,244	7·001	6·683
Victoria	247,261	33,475	7·386	7·270
Macknade	200,732	27,948	7·182	7·011
Total for Northern District ..	2,270,430	311,825	7·281	6·862
Invicta	78,617	11,844	6·638	6·520
Pioneer	166,902	25,283	6·601	6·486
Kalamia	204,302	31,309	6·525	6·485
Inkerman	219,988	33,635	6·540	6·488
Proserpine	172,066	24,004	7·168	6·878
Cattle Creek	63,005	8,242	7·644	7·028
Racecourse	153,689	21,509	7·145	7·063
Farleigh	144,263	19,456	7·415	6·863
North Eton	68,364	9,080	7·529	7·561
Marian	137,862	19,070	7·229	6·910
Pleystowe	155,422	21,596	7·197	6·860
Plane Creek	172,725	24,652	7·007	6·612
Total for Central District	1,737,205	249,680	6·958	6·722
Qunaba	51,636	5,783	8·929	..
Millaquin	103,914	12,151	8·552	9·160
Bingera	118,070	13,651	8·649	9·049
Fairymead	117,356	13,454	8·723	9·667
Gin Gin	16,166	1,631	9·912	9·275
Childers	..	..	..	8·347
Isis	94,977	10,762	8·825	9·352
Maryborough	29,088	3,716	7·828	8·589
Mount Bauple	27,267	2,956	9·224	..
Moreton	82,362	10,932	7·534	7·618
Rocky Point	15,979	1,921	8·318	9·147
Eagleby	2,578	272	9·478	10·000
Total for Southern District ..	659,393	77,229	8·538	8·784

Brisbane, 14th December, 1934.

H. W. KERR,
Director.

Price, 2s.]

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